INDIAN FOOD INDUSTRY

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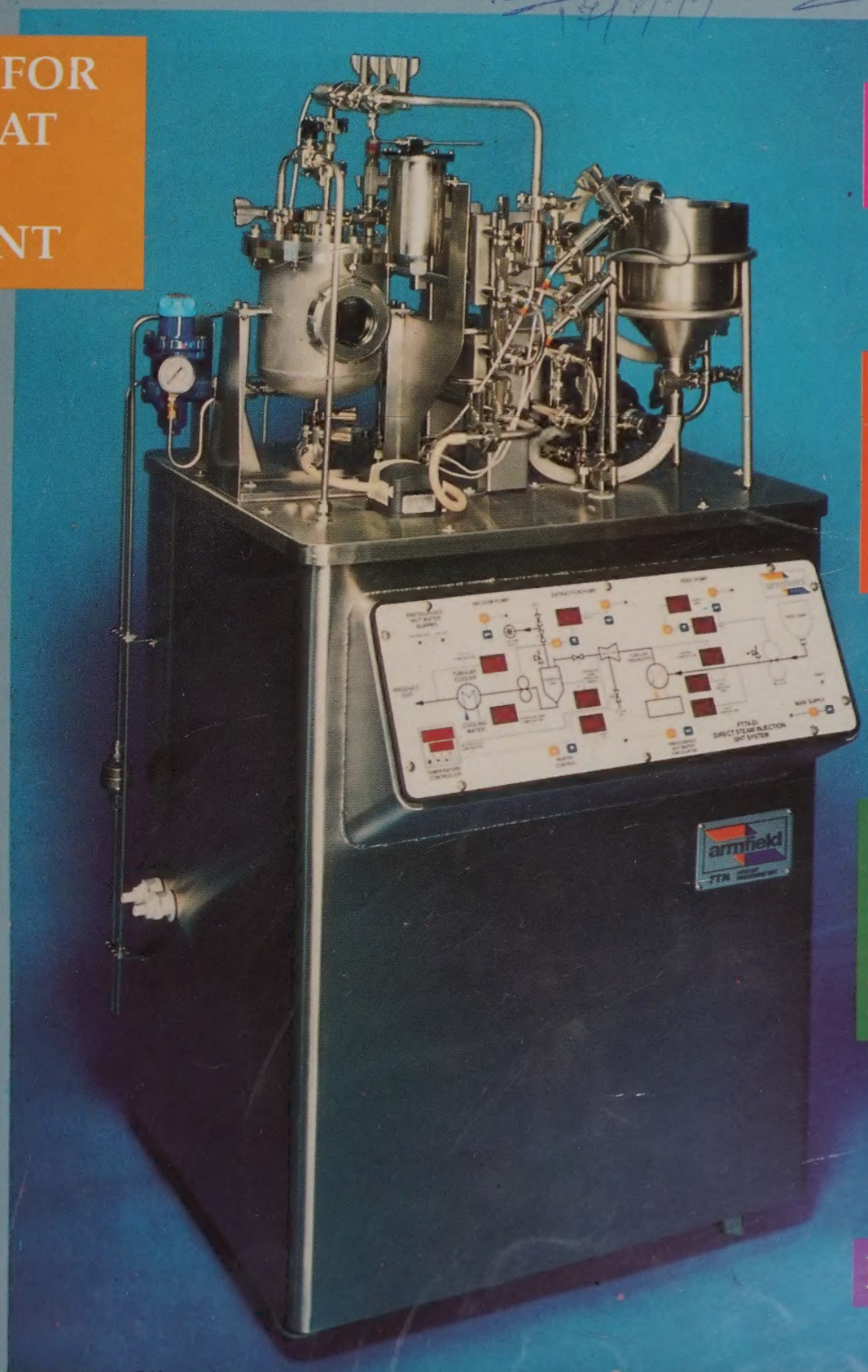
A PUBLICATION OF ASSOCIATION OF FOOD SCIENTISTS AND TECHNOLOGISTS (INDIA)

PROBIOTICS FOR POULTRY MEAT QUALITY IMPROVEMENT



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- The Association is a professional and educational organization of Food Scientists and Technologists, with its headquarters at Mysore.
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- Holding symposia/conventions on different aspects of Food Science, Technology and Engineering.
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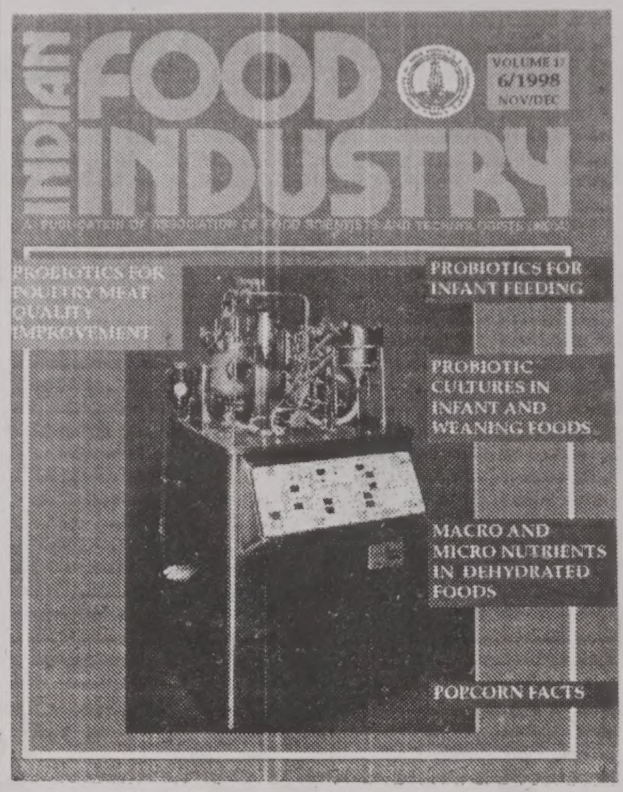

A self-contained miniature-scale direct steam injection UHT Unit.

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Indian Food Industry (ISSN-0253-5025) is a bi-monthly publication of the **Association of Food Scientists and Technologists (India),** devoted to give extensive coverage to technological and market development relevant to food industries in India.

Review articles, technology papers based on R&D work and reports on various aspects concerning food industry are welcome from food scientists and technologists from industry, research institutions and other related organisations. Contributors are advised to provide good quality illustrations in the form of charts and photographs along with the manuscripts. The Editorial Board reserves the right to edit the manuscripts in order to make them suitable for publication in the journal, while assuming no responsibility for the statements and opinions expressed by the contributors, nor will they bind AFST (1) in any way. Readers are free to air their views through letters which may be published in the journal from time to time.

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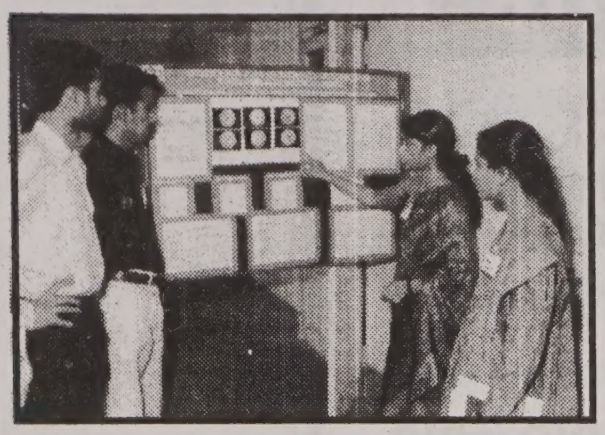

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In one of those never ending debates on vegetarianism versus non-vegetarianism, someone remarked that meat eating will make the person cunning, selfish and ferocious. To substantiate this view, examples of all the carnivorous animals, the lion, the tiger, the jackal etc., were cited. This argument was countered vehemently by others indicating that the carnivorous animals have evolved that way with such attributes which are need-based, like the fish with fins to swim in water or the butterflies with long probosis to reach nectar at the deep labyrinth of flowers. We, however, have some knowledge now on how food can influence emotions and behaviour. In ancient Indian thought, food is one of the factors which determines the satvika *(saintly),* rajasika *(carnal and sensual pleasure seeking) and* tamasika *(foolish and lazy) traits in humans.*

Most importantly, new knowledge indicates that food can have profound momentary physiological effects on vital functions that reflect health or ill health. In this context, it would be too naive now to regard food as merely proteins, carbohydrates, fats, vitamins, minerals and fibre. Food is also a source of scores of unique organic molecules, the steroids, alkaloids, phytamines, catechins, flavanones, pigments, tocols, opiod peptides etc. Their influences on blood pressure, blood lipid profile, inflammation, aches and even libido have been known, although more authentic experimental data on specific effects are not completely available. In the recently held International Food Convention (IFCON-98) at Mysore, a good proportion of discussions dealt with health foods, functional foods, probiotics etc, which have a bearing on the types of foods and their processing to render them for specific needs in promoting health. Indian Food Industries should awaken to these changing trends in food concepts soon, before unexpected quarters unscrupulously exploit this knowledge to their advantage.

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INDUSTRY NEWS

SmithKline to Invest Rs. 2450 Crores in Horlicks Plant

Smithkline Beecham Consumer Healthcare, will invest Rs. 240 crores to set up a new plant in Haryana to increase the production of Horlicks. The new plant will produce all the existing sub-brands under Horlicks, said Mr. Daniel McDonald, Managing Director, SmithKline Beecham Pharamaceuticals India (SBPI).

Land for the new plant has already been acquired. Modalities of the project are being worked out.

Meanwhile, SBPI is going to introduce a Heaptitis A vaccine called Harvix and a vaccine for Chicken Pox in the next six to nine months in the local market. " It is for the first time that such drugs will be available in India," said Mr. McDonald. However, HiB (Hemarphous influenza type B) meant for meningitis, which the company is planning to introduce in a year's time, is already available in the Indian market. All the drugs will be imported from Belgium.

The SBPI chief also said that the one-year contract SmithKline Beecham signed with the Hyderabad-based Indian Institute of Chemical Technology may be renewed if the end products meet the company's demands. Presently, both the parties are working on development and optimisation of selected solid phase chemistry synthesis reactions.

Around 9,000 compounds are developed during the research process and are sent to the US and UK where the molecules are tested for extended potential for therapeutical value.

On the export front, SmithKline Beecham International sources drugs for the African continent from India. Total exports supplied to SB from SBPI and other Indian sources stood at Rs. 65 crores during the last fiscal year.

A small part of the total export earnings of SmithKline Beecham this fiscal will be invoiced to India through subsidiary.

The company is focussing on increasing its export volume through a major thrust in its priority areas in pharmaceutical products.

The company is also likely to step up focus on its range of nutritional drink brands in future. This is in tune with the company's goal to consolidate its Indian presence.

Segmenting the company's health food drink brands based on specific needs of specific age groups is the priority, an example being its recent brand launches-Junior Horlicks or Mother's Horlicks. According to the General Manager, the company is sticking to its global philosophy of a science-based health care formula. Innovations in its brands are therefore linked to new nutritional breakthrough made by R & D division. The company has announced the launches of "New Horlicks with Smart Nutrient", a new formulation which incorporates micronutrients.

Increased Imports Could Affect Sugar Output

A sharp dip in world sugar prices and fierce competition from importers could hit future Indian sugar output. Indian traders, taking advantage of a crash in world sugar prices, were importing sugar in large quantities and this could have long-term implications on production.

India allowed sugar imports free of duty in 1994-95 (April-March) to keep a lid on prices after a fall in production. Sugar production has since picked up, but the government has continued its policy of imports without duty, which the industry says has depressed local prices.

While imports are wholly without duty, domestic producers have to pay certain local taxes and excise.

The European Union has produced far more sugar than originally estimated and it is desperate to export. Pakistan has huge surplus of sugar and Thailand has also excess sugar due to the Indonesian currency crash. These countries were dumping sugar in the world markets at below cost levels. Between October 1 and February 28, India had imported 200,000 tonnes of sugar from Brazil, 58,000 tonnes from the European Union, 35,500 tonnes from Thailand and 17,500 tonnes from Pakistan.

It has been estimated that the total imports since October were 352,000 tonnes. Under India's regulations, sugar mills are required to supply 40 per cent of their output at a subsidised rate for distribution among the poor, The rest is sold on the open market. India has eased controls on many industries as part of a seven-year-old liberalisation process, but sugar still remains a highly regulated sector with govern-

ment controls on production and pricing.

Sugar Prices Under Pressure Due to Decontrol

The Indian government's planned phase-out of decades-old controls on the sugar sector will help ensure a level playing field for local industry but prices will come under pressure in the short term.

"If the controls are eased, the market will initially see a drop in prices because of increased supplies," said a leading sugar trader based in Mumbai, India's commercial capital. " But firms will compete to boost output and that will help actually trigger sugar exports in them long run," the trader said.

India is the world's largest sugar producer. A government-appointed panel has proposed a partial removal of control over the domestic sugar industry and total deregulation of the existing dual sugar pricing system within two years.

The impact of these recommendations, if implemented, would mean lower sugar prices and a far better level playing field to end users. The new Indian government led by the Bharatiya Janata Party is expected to study the report and come out with its views in a month's time.

The new pricing system is expected to boost investment in the industry and improve its financial health.

Despite easing of controls on many industries as part of a seven-year-old economic reform process, the Indian sugar sector is highly regulated with government controls on production and prices.

Sugar Mills May be Allowed to Use Poly Sacks

The Union government may allow the sugar industry to pack a portion of its production in poly sacks. This is in line with one of the recommendations made in the Mahajan Committee report.

If the recommendations are accepted, the sugar industry will be allowed to pack 20 per cent of its production in non-jute packaging materials, Incidentally, the high powered standing advisory committee on jute had also made a similar observation. The move to use poly sacks follows the problems of erratic supplies of A Twill bags early this year to the sugar industry. The packaging cost of jute bags is three times more compared to HDPE sacks.

Indian Exporters' Dilemma Over US Sanctions

A great deal of confusion prevails amongst Indian exporters as no government agency has attempted so far to clarify whether the economic sanctions imposed by the U.S.A. under its Glenn Amendment apply to trade.

Sources in the commerce ministry said several exporting houses have complained that US buyers who were in New Delhi for negotiations have gone back to consult their government.

Some exporters who were holding talks with potential US importers told the ministry that they left negotiations half-way saying they needed to speak to their lawyers and government officials as they get huge assistance from various government agencies back home.

Sources said that US buyers of Indian goods first tried to speak to officials at the US embassy. But when queries could not be answered satisfactorily, they decided not to sign contracts in haste. Since sanctions under the Glenn amendment have been imposed for the first-time, US embassy officials are not sure whether it applies to bilateral trade too, explained an official.

The same is the case with officials of the ministry of external affairs. When asked, a senior official, replied that they had asked the Indian embassy in the US to find out details about the sanctions.

Meanwhile, confusion rules even as trade remains in a state of depression. In 1996-97, Indian exports registered a growth of 2.56 per cent in rupee terms and a negative growth in dollar terms. If ministries continue to remain tight-lipped, exporters fear they might lose potential buyers to competitors.

The US accounts for as much as 26 per cent of our exports. A large number of star trading houses have initiated the process of negotiating the price and signing the contact for this fiscal year. Trade observers feel that both India and US are members of the WHO, and such unilateral sanctions cannot be applicable to it. However, there is no concrete answer to it.

Now - It is Red Revolution

It is the turn of the Red Revolution after the Green Revolution, the White Revolution and the Poultry Revolution, according to Dr. A. P. Sachdev, the Delhi-based co-ordinator of the US Grains Council.

He told a meeting of sheep and goat rearers in Bangalore that their time had come. They accounted for some 35 per cent of the domestic meat production.

What is now needed is to improve both the quantity and the quality so as to not only meet the needs of the market but also to improve the living standards of those rearing the animals. There has been little scientific management of sheep and goats in India.

There was a move to set up a national board for development of sheep and goat on the lines of the NDDB or the national board for the poultry industry and he was confident that the government would react positively.

Referring to the initial attempt by the private sector to improve breeding technology on 500 acre farm of the Nagpur-based Shivaji Estate Livestock Farms (Self), Dr. Sachdev emphasized the need to improve marketing so as to strike when the demand was hot. Applications of technologies like artificial insemination could, he said have multiplier effect in terms of boosting both quantity and quality.

Thanks to a thorough programme of artificial insemination; some 95 per cent of the sheep had become fine-wooled in 50 years.

Nestle To Take Over Dabur's Excelsia Foods

Nestle India, is poised to take over Excelsia Foods Ltd with Dabur India agreeing to reduce its share holding in the company from 60 per cent to below 50 per cent by selling equity to the Swiss food major.

At present, Dabur holds a 60 per cent holding in Excelsia with Osem of Israel holding the remaining 40 per cent. Nestle is the largest shareholder in Osem and owns a controlling 40 per cent stake in the Israeli company.

According to sources, Dabur and Nestle have reached an in-principle agreement whereby the Indian company will relinquish control and reduce its holding to below 50 per cent in the joint venture. With this, Nestle's effective holding in Excelsia will go up to atleast 51 per cent.

Industry sources say it is likely that Nestle will acquire Dabur's shares through its India subsidiary — Nestle India — but this has not been finalised so far. Sources also add that it is possible that Dabur might not reduce its holding in one go and might instead take place in phases. However, management control will be transferred into the hands of Nestle.

While an in-principle agreement has been reached between Dabur and Nestle, sources say no formal agreement has been signed so far.

Dabur, on its part, says that sources have been amenable to the proposal as it feels that it should concentrate on ethnic foods rather than western snack foods and speciality bakery products which form part of Excelsia's proposed product portfolio.

Excelsia is a fledgling food company which is currently selling its Creamwich range of snack foods and proposes to launch cookies and crackers in the near future.

Scientists Urged Not To Introduce 'Exotic Bees'

The "Save honey bees campaign," a non-government organisation, interested in protecting bee-keeping, has firmly opposed the introduction of "exotic bees" into the country.

The introduction of "exotic bees", could lead to unknown ecological disease and destroy bio-diversity. The need of the hour, they said was to final disease-resistant strains of local honey bees and propagate them. The Indian honey bees of the genus "Avis Cerana" and "Apis Dorsata" should be protected. The statement was made at an FAO Workshop on "Sustainable bee-keeping development".

According to Mr. Pandurang Hegde, the introduction of the exotic Italian honey bee "Apis Mellifera" in south, had created a controversy over its adaptability to tropical climate. Apiculture, was facing a crisis in Karnataka due to the spread of a virus disease known as the Thai Sac Brood Virus (TBSV). The virus had destroyed 90 to 98 per cent of bees in Karnataka. Production of honey, as a result, had come down from 750 tonnes in 1991 to 200 tonnes in 1998.

The Government agencies and bee keeper's societies had imported Apis Mellfera honey bees from north India and West Bengal. However, hundreds of these colonies had failed to survive in the Malnad regions.

A study done by Dr. Chandrasekhar Reddy from the Bangalore University on the introduction of exotic bees, had revealed that 95 per cent of bee colonies had met with failure, and those surviving were living on a heavy diet of sugar. Exotic bees were not resistant to local mites and needed constant medication. Exotic bees had not produced a single kilogram of honey in the Western Ghats.

A paper presented at the workshop by Dr. Clin from Vietnam revealed that exotic bee-keeping was capital-intensive with an investment

of $ 1380 per colony when compared with $ 206 required for indigenous bees. The profit earned by local bee-keeping was $ 406 whereas for exotic variables it was only $ 155.

Philippines Plans to Double Coconut Exports

New Philippine Coconut Authority (PCA) administrator Eduardo Escueta said that the agency would launch a programme to help double coconut production and exports.

Under the programme, Escueta hoped that coconut production which has averaged 2.3 million tonnes (in copra terms) annually in the last five years would also double. Escueta further hoped that the targets would be met within the six year term of the new administration.

The programme will provide for appropriate fertilisation to improve the yield of coconut trees, implement inter-cropping of 500,000 hectares of coconut land and provide water supply within "inter-cropped" areas. He added that of the total three million hectares planted to coconut in the Phillipines, 70 per cent is not "inter-cropped" or planted with other high-value crops. He said that the scheme will also call for the replanting of coconut land lost to tree-cutting and education of the coconut farmers to make them not only producers but entrepreneurs as well. He added that coconut tree-cutting if left unabated would wipe out an average of one million trees a year.

Karnataka Plans Policy for Food Processing Industry

Karnataka is on the threshold of unveiling a new food processing industrial policy with an attractive package of incentives and concessions to lure investments in the sector.

The draft policy has been sent to the state planning board for its views.

In the draft, the government has proposed tax holiday and further amendments to Land Reforms Act to increase land holdings by the food-processing industry in the wake of demand that at least 50 per cent of the land requirement be owned by those setting up the industry.

Karnataka had earlier amended the Land Reforms Act to provide for acquiring a maximum of 102 acres land for a unit and the amendment earlier evoked sharp protests.

Offering attractive incentives and concessions to lure the industrialists to invest might not help and any decision should be on a justifiable line.

Karnataka had already unfolded a new agricultural policy and software policy. State planning board's meeting would review the basic needs of the state, urban transportation system, financial policies and the exclusive agro-based food processing industrial policy.

Three New Firms to Take up Oil Palm Processing in Karnataka

The oil palm development project in Karnataka has received a fresh boost with three companies offering to take up oil palm development in the Tungabhadra command area and Bhandra (second) command area. The companies, Simhapuri Agro Products, Radhika Oil Mills and Food Fats and Fertilisers, have expressed their interests in taking up the oil palm project in the command areas.

The oil palm project, taken up in the States of Andhra Pradesh and Karnataka, envisaged the private sector participating in the area of development and processing. Of the eight companies that had originally invested in the project in Karnataka, only two companies Palmetch and Karnataka Oswal are still committed.

Things are looking up now as prices have recovered and palm oil is currently fetching about Rs. 30,000 per quintal. Two of thee new companies are familiar with the oil palm industry. Food Fats has a oil palm processing unit in Andhra Pradesh.

The Karnataka government now proposes to offer Bhandra (second phase) to Radhika Oils Mills, while the Tungabhadra command area is likely to be divided between Simhapuri Agro and Food Fats and Fertilisers. The proposal however, has to be first cleared by the State cabinet.

On the progress of the area development project in Karnataka, as against the Ninth Plan target of covering 18,000 ha under the crop, so far covered, only about 8,100 ha has been achieved.

The research and development (R & D) efforts in oil palm must now focus on identifying suitable intercrops so that there is optimum land use. The state horticulture department is shortly planning to take up a demonstration plot in Shimoga where oil palm would be intercropped with vanilla.

Oil Board For Domestic Industry Mooted

The domestic edible oil industry has demanded constitution of an oil board to ensure development of oilseed and vegetable oils sectors.

The proposed board should be formed on the lines of existing boards for coffee, tea, rubber and jute, under the jurisdiction of the ministry of food and consumer affairs for better industry growth. According to Indian Vanaspati Producers' Association (IVPA), a proposal has been submitted to the ministry and this body would ensure proper co-ordination between various industry segments, government and other agencies involved in promoting oilseed cultivation. The proposed board's powers will encompass the farming sector, oil extraction industry, processing industry and the vanaspati industry. Since the above segments are economically interdependent, there is need to have a policy for the development of the entire sector."

Earlier, The parliamentary Standing Committee on food and civil supplies had recommended constitution of an oil board to help formulate policies and coordinate the growth of this sector.

The board should have the Union food and civil supplies minister as its ex-officio chairman and the sugar and edible oil secretary as its vice-chairman.

It should have atleast 22 members, including representatives of the commerce and finance ministries, Planning commission, vegetable oil production controller and representatives of various segments of the industry. The proposed structure for the board differs from that of the existing rubber, tea and coffee boards where civil servants act as chairmen.

Demand for Indian Marine Products Picking up in EU

Indian exports of marine products to the 15-nation European Union (EU) are picking up again, four months after EU authorities lifted their ban on imports of these products.

Ten companies from India are authorised to export to the EU, because they meet the necessary health standards. The value of order booked is estimated at around $ 25 million, including a single order for $ 8 million.

The fact is that just 12 per cent of India's current seafood exports of $ 1.2 billion consists of value added products. However, there are hardly any ready-to-eat consumer packs for sale through department stores.

The future lies, however, in sales through supermarkets, according to Mr. G. Mohan Kumar, Marketing Director at the marine Products Export Development Authority (MPEDA). It is not that Indian firms are unable to turn out consumer packs. However, the reason why majority of Indian exporters have stayed away from consumer packs and ready-to-eat products are economic as well as psychological

Experience suggests that value addition will require foreign collaboration. Many Thai firms are joint ventures with American and Japanese firms — Thai seafood exports are roughly three times the size of Indian exports.

But the developments suggest that Indian exporters will need to focus on value addition in future. Indian prices are rising, not only because of poor catches but also because of the investments processors are making in order to meet EU health requirements.

At the same time, prices are coming under pressure. Because of the financial crisis in south East Asia, prices of exports from the region have fallen. European importers are therefore, pressing Indian exporters to cut their prices. Indian exporters can resist the pressure as regards two of their main exports to the EU — cuttlefish and squid— because of their better quality. The MPEDA is prepared to help firms go in for value added items.

SAARC Countries Can Now Export Plantation Produce to India

Tea, coffee, rubber, onion and cotton are among the 2000 items on which India has removed import restrictions for South Asian Association for Regional Cooperation (SAARC) members. But import restrictions for items restricted on non-BoP grounds as well as canalisation would continue.

The notification on the removal of quantitative restrictions on imports, maintained for balance of payment. (BoP) position was issued following a statement made by the Prime Minister Atal Bihari Vajpayee in Colombo at the 10th SAARC convention. Mr. Vajpayee had told other

SAARC members that import curbs would be removed as a special gesture towards the community.

As per the notification, tea green in packets not exceeding 25 grams, green tea in packets up to 20 kg, tea green in bulk, tea green waste, black tea up to 20 kg, tea black in bulk, tea bags, tea black waste and instant tea would be allowed to be traded freely. However, these imports are likely to be subjected to import duties as only restrictions on quantities of import have been lifted.

Similarly, import restrictions on all varieties of Arabica and Robusta coffee and cotton and onion have been removed. As far as rubber is concerned, import curbs on natural rubber latex, prevulcanised natural rubber latex, smoked sheets and crepe rubber and estate brown crepe have been removed.

Removal of the curbs on tea and rubber is expected to benefit Sri Lanka in a big way as it feels it could tap the huge market potential here.

The island country also has a price advantage as input costs, especially labour wages, have been on the rise in India. Though not of Darjeeling quality, Sri Lankan tea is considered better than the quality produced in South India. India tea industry has been stubbornly resisting any move to allow tea imports, particularly from Sri Lanka.

Good Monsoon Brightens India's Crop Production

The renewed monsoon has brightened crop prospects all over the country and the government is optimistic of achieving the food grain target for the year. Going by the present progress, it should be possible to achieve, if not exceed, the foodgrain production target of 107 million tonnes set for the kharif season. The sown area for most of the crops is more than last year and no major pest or disease has been reported from any State.

The meteorological department has reported in its midseason review that barring the northwestern region comprising Punjab, Haryana, Rajasthan and Delhi, the monsoon has resumed in all parts of the country. In the last four days, rains have also revived hopes of farmers in some problem areas such as the northern parts of Orissa, western parts of West Bengal, eastern parts of Madhya Pradesh, the Saurashtra region of Gujarat and the Vidarbha region of Maharashtra which had less rainfall.

A crop-wise analysis shows that for rice, the main monsoon crop, the area covered this year is 15.2 million hectares against 15 million hectares last year. In sorghum (jowar), the coverage has been 3.6 million hectares against last year's 3.5 million hectares. Similarly, in pearl millets (bajra), the coverage in six million hectares against last year's 3.5 million hectares.

Land under the maize crop is 3.26 million hectares against last year's 2.7 million hectares.

Area under sugarcane is expected to go up by 200,000 hectares to four million hectares against last year's 3.8 million hectares. Although the sugarcane coverage is less in Punjab this year by 60,000 hectares, the shortfall has been more than made up with increase in Rajasthan to 50,000 hectares and Andhra Pradesh to 200,000 hectares.

As for crop grown conditions, reports from States, show that the rice prospects are good, except in some places like parts of Rajasthan, Orissa and Eastern Madhya Pradesh where the coverage under the crop has suffered because of low rainfall. No crop disease has been reported from rice growing areas.

Pulses and oilseed crops have been doing well and among them soybean is said to be in excellent condition, since it is free from rust incidence. The targets set for various kharif crops this year are: rice-73.2 million tonnes, jowar-seven million tonnes, bajra-seven million tonnes, ragi-2.5 million tonnes, smaller millets-800,000 tonnes, maize-10.5 million tonnes and pulses-6.1 million tonnes. Among commercial crops, a target of 14.8 million bales has been set for cotton and 300 million tonnes for sugarcane.

The government is now preparing an action plan to double food production in ten years. Under the plan, the agriculture ministry, in consultation with States, is trying to revise upward the overall target for foodgrain production this year, earlier fixed at 203 million tonnes for both kharif and rabi.

The monsoon set in on time this year and the cloud spread was good all over the country, except for the break from mid July. From June 1 to July end, out of 422 districts in the country for which rainfall records are maintained by the meteorological department, 96 had deficient rain while eight had scantly rain.

UB Launches Speciality Ice Beer

The United Breweries has launched a new speciality beer UB Ice with higher alcohol content of 6 per cent. This is the first time that an ice beer has been introduced in the country.

The Ice beer is considered a

speciality beer as its process of manufacturing is different from brewing process of regular beer. Explaining the difference between the two, ice beer was lagered longer than the regular beer and the temperature at which it is manufactured was very low and hence the beer is called Ice beer.

UB ice is being manufactured in the company's Bangalore brewery and has been launched in some parts of Maharashtra. This beer, was available in special bottles with labels giving a hologram effect. The beer is available in a case of 24 bottles and is priced at Rs. 27 per bottle.

About another beer brand, Kingfisher, the company has launched Kingfisher mineral water also.

It is a big project with manufacturing facilities in Karnataka, Mumbai, Andhra Pradesh and Tamil Nadu. The company has franchises agreement for manufacturing and distributing mineral water.

Shaw Wallace to Set up R & D Centre

Shaw Wallace and Co. (SWC) is gearing to take its competitors head-on by setting up a research and development centre, upgrading its distilleries and improving marketing and distribution network.

The company has set up an R & D centre at Maharashtra Distilleries, Aurangabad. The Indian liquor brands need to continuously upgrade themselves to match international standards. Worldwide, quality and consistency have been identified as the two most cherished qualities when it comes to liquor brands.

Many of the international brands have made a foray into Indian made foreign liquor (IMFL) segment, posing a tough challenge to brands fielded by Indian companies.

In super premium whisky segment, there are two international players Seagram and IDI who have launched Blender's Pride and Gilbey's Heritage respectively. Similarly, in premium whisky segment, Seagram and Whyte and Mackay have introduced Oaken Glow and Genesis respectively.

There is only one foreign player, IDI, in prestige deluxe whisky segment which has launched Gilbey's Old Gold and Gilbey's White. In regular whisky segment, IDI and Seagram have launched Gilbey's green and Royal Stag, while IDI has launched Gilbey's gin and Smirnoff vodka.

SWC's quality products had carved a niche for themselves in several international markets. The company's brands are rapidly gaining popularity in West Asia, South East Asia, the Far East, Japan, North America and Russia apart from the traditional export markets of the neighbouring countries.

Glaxo Division Ties Up with U.K. Firm

Qualigens Fine Chemicals (QFC), a Division of Glaxo India, has entered into a tie-up with the U.K. based Oxoid Ltd, for making a range of culture media and microbiological products.

Under the terms of agreement, QFC will initially market a select range of 50 Oxoid products, comprising mainly dehydrated culture media and biochemicals with a varied application in the pharmaceutical, brewing, healthcare, cosmetic testing and food and dairy industries, veterinary science and waste water treatment.

According to a release by Glaxo India, Oxoid is a leading player in the culture media range of products with more than 150 products.

QFC markets a wide range of fine chemicals, diagnostic kits, disposable labware, liquid handling instruments and disinfectants.

Ban on Use of Non-Iodised Salt Justified

The Union Health Ministry, rejected the opposition to the ban on consumption of non-iodised salt and renewed its appeal to the public to ensure that they consumed iodised salt only.

The Union Health Minister said that iodised salt was one of the most effective economic and cheapest ways to control the iodine deficiency disorders and community participation was the most essential aspect of the fight against these disorders. He also said that though it might not have drawn much attention, as it did not cause death. Deficiency of iodine was one of the major public health problems of the day since it led to goitre and mental and motor disorders.

The government had imposed a nation-wide ban on use of non-iodised salt for human consumption on November 27 last year, but following cases filed in the courts in different parts of the country, the ban order is presently not operational in Kerala and parts of Andhra Pradesh and Maharashtra.

The ban was imposed on the ground that not a single State or Union Territory was free from the problem of Iodine Deficiency Disorders, which manifests in the form of endemic goitre or mental or motor disorders. According to the Health Ministry, more than 61 million persons in the country were estimated to be suffering from endemic goitre and 8.8 million from mental and motor disorders.

Several social activists, on the other hand, have opposed the ban on the ground that it would have an adverse affect on the traditional salt industry, make salt out of reach for the common man and also lead to a new set of health problems in the absence of measures to prevent excessive consumption of iodised salt.

The officials in the health ministry have however, rejected these apprehensions. According to them, iodisation was not that costly and so far no case of any health problem due to excessive iodine has been reported.

Iodine deficiency disorders occur when the iodine intake is less than 150 microgram per day over a long period of time. The consequences range from lowering of IQ to cretinism with severe mental defects, and increased rate of abortion, stillbirth, congenital abnormalities, low birth weight and infant mortality.

KMF to Set up Mineral Water Plant

The Karnataka Co-operative Milk Producers' Federation (IKMF) is planning to set up a mineral water plant at Munenakolala,near Bangalore, at an estimated cost of Rs. 1.5 crores. The proposal had been sent to the National Dairy Development Board (NDDB) for clearance.

In keeping with the KMF's intent of giving more milk-based products to the consumers, cheese, "Mysore pak" and icecreams in the brand name Nandini are on their way to hit the market. Trial runs are going on at Kolar where the cheese will be out in the market in about one and a half months. While the Nandini, "Mysore pak will be available in three months, the icecream production will be launched in January next. Currently the Mother Dairy, Bangalore, a unit of the federation is producing over 3,000 litres of icecream under the brand name "Amul."

According to Mr. Revanna, the Minister for Housing, Nandini (The brand name for KMF products) is a market leader in the South. While the southern co-operatives put together enjoy a market share of 46 per cent, Nandini accounts for 37 per cent.

The KMF, which is supplying 40,000 litres of milk a week to Calcutta, is likely to increase it by another 40,000 litres from November 1, Maharashtra and Kerala are two other States that get milk from the federation to the tune of 10,000 litres and 40,000 litres respectively everyday.

The cattle feed production plant which was opened recently is the fourth such and, together with the other three, will produce 500 tonnes of balanced cattle feed per day.

The plant is a modern one being commissioned at an outlay of Rs. 6.25 crores. The plant has some special features including a programme logic control, regulated batching systems, micro processor-controlled bag scaling unit with weight sensitisor and a 40 MT digital weightbridge.

The Rs. 50 crore Mega Dairy project of the KMF coming up at the Hosur Road complex was expected to be completed in 14 month. It would be the largest plant next only to the NDDB's with a capacity of six lakh litres. The KMF's milk procurement had touched 18.5 lakh litres a day. Sometimes, it went up to 20 lakh litres.

Among the projects of the KMF were the milk powder making plant, modernisation of the Nandini milk unit, a cold storage plant at Nagashettyhalli and sterilised and homogenised milk in tetra fibre pillows. The shelf life of this milk will be 45 days.

The turnover of the federation, which was Rs.11 crores in 1977-78, had gone up to Rs. 728 crores in 1997-98. In all, 17,378 villages had been covered under the co-oprative dairying network.

CAMPCO Research Foundation Opened

The Central Area Marketing and Processing co-operate (CAMPCO) Limited, which is in its silver jubilee year, has opened an Area Research and Development Foundation.

The Foundation has done extensive research and has suggested industry various alternative uses of areca, which were not known to the industry. One of the first such products to be introduced in the market on an experimental basis is "the kaju-supari", which is a unique blend of two important commercial crops in the region, cashew and areca. It has initiated research into the medicinal properties of areca with the support of Ayurveda College in Udupi, Dakshina Kannada..

Talks were held with Bangalore-based companies to extract six per cent alcohol from areca, which would make commercial production of areca beer possible. A German company had envinced interest in extracting colouring agents from areca.

The Foundation would partially fund the process of amalgamating all the unorganised research being carried out in various parts of the country in which areca was being grown and in which research was being done.

In view of the Union Government thinking of banning "gutkha", the future of arecanut appeared uncertain. About 84 per cent of contents of "ghtkha" was areca. Elsewhere in the country some "unorganised" research was going on to promote other uses of areca and the Foundation would bring such research 'under one roof" and try to develop commercially viable areca-based products. The Foundation would initially have a Rs. 50 lakh fund from contributions of its members and areca growers at the rate of Rs. 100 an acre.

A Medical herbs research organisation in Pune and another in Lucknow had conducted research into the edible and medicinal qualities of areca. With Government deciding to ban "gutkha", over 20 lakh areca growers in the country would face an uncertain future. The areca industry provided direct and indirect employment to over three crore people in the country. Nearly 13 million "panwallas" were making a livelihood by selling areca and areca products. The Rs. 1,000 crore "Gutkha" export market would suffer if the product was banned and more so the arecanut industry.

The Health Ministry should weed out the carcinogenic agents in "gutkha" and ban the particular additive from being used in "gutkha".

At present, 4,15,000 tonnes of areca were being grown in the country, out of which Karnataka had the lion's share of 38 per cent with 1,60,000 tonnes being grown annually, followed by 25 per cent in Kerala and 20 per cent in Assam which were the major areca growers. Nearly 3,75,000 hectares were under areca cultivation of which there were 1,90,000 hectares of land under areca in Karnataka. Since "gutkha" industry was the major user of areca, it may not be a good idea to ban it.

Centre Urged to Exempt Rose Onion from Export Ban

Mr. D. L. Nagaraju, President of Kolar District Krushik Samaj, has urged the Union Government to exempt the "rose onion" from export ban.

He said that the Union Government's decision to ban export of onion was welcome in view of the recent steep hike of onion prices in domestic market. However, he said that Indians did not use rose onion, which were meant exclusively for export.

Giving a detailed account of onion production in various parts of the country, Mr. Nagaraj who is also one of the Directors of the Pradesh Krushik Samaj, said that in Karnataka the farmers grew Bellary onion and Challakere onion besides KP onion, and Nasik onion.

Stating that the farmers of Kolar were engaged in growing of rose onion, Mr.. Nagaraj said that more than 2,500 acres in Kolar district had been used for this type of onion and in the last two seasons, the State Government did not make any arrangements for marketing of the commodity.

According to him, this variety is being sold at a throw away price of Rs. 2 to Rs. 4 a kg. He said that in Kolar alone more than 2.5 lakh tonnes of rose onion were ready for market but there were no buyers.

He urged the Government to exempt this variety from ban on export.

Mr. Nagaraj said that rose onion was in demand in Singapore, Sri Lanka and Malaysia. It was only with the intention of exporting the commodity, the cultivation of rose onion was taken up during the past 10 years in Bangalore and Kolar districts. He urged the MPs from Kolar and Bangalore districts to pressure the Union Government to exempt rose onion from ban on export.

Revival Package-Reactions of Industry and Market

Captains of industry and capital markets have welcomed the package of measure announced by the Prime Minister Mr. Atal Behari Vajpayee, to reinvigorate the depressed stock markets and sagging economy.

"We were expecting announcement on buy back of shares for so long. It will improve the market sentiments," a cheerful FICCI president Mr. K. K. Modi, said immedi ately after the Prime Minister's an nouncement.

However, the Former Finance Minister Mr. P. Chidambaram had his reservations and said that the package concentrated mainly on the financial aspects and ignored technological and trade aspects relating to the globalisation.

He asked the Government to immediately come out with an ordinance to facilitate buy back of shares by companies.

He said that the policy makers should have the courage to shun rhetorics and initiate correct policy measures to curb inflation.

The President of Delhi Stock Exchange, Mr. Deepak Chowdhury, exuded confidence that the announcement would have positive impact, provided these materialize in short time.

"The Government should also take measures to revive the economy and further boost infrastructure spending," he said.

The former member of the Security and Exchange Board of India (SEBI), Mr. L. C. Gupta, said buyback of shares had been announced under pressure from businessmen and was not in the interest of small investors.

The Associated Chambers of Commerce and Industry (Assocham) described the announcement of buy-back as a positive step and said all chambers had been asking for it for long.

The assurance by the Prime Minister must result in positive action", Secretary-general of the chamber Mr. E. N. Murthy said.

The DSE broker, Mr.. Bharat Bhushan Sahny, said that the introduction of buy-back will help the corporates to stop bear-hammering on the scrips. "Cash-rich companies can buy shares from the market if the price goes below the intrinsic value. Buy-back will allow corporates to come to the rescue of small shareholders," Mr.. Sahny said. However, the assistant director at ANZ Investment Bank, Mr.. Pramod Kumar, said buy-back was sensitive issue and proper safeguards should be in place to prevent manipulation by promoters.

"Buy-back should not be used by promoters to hike their holding in companies. Further, corporates should be asked to justify the rate at which companies buy their shares," he said.

Green Bench Orders Closure of Highly Polluting Units

The Green Bench of the Madras High Court has directed the Pollution Control Board (PCB) to close forthwith 941 highly polluting industries in Tamil Nadu.

These and 1,020 other units have been identified by the Board as falling within the one km radius of water sources (rivers, canals and streams) in the State, which was prohibited as per a G.O. issued in March 1989. They included tanneries, dyeing units, chemical, sago and ceramic industries and foundries.

The Bench directed the PCB to seal these 941 units and take all other steps to perform their duty enjoined on it by the Rules and Regulations. The State administration, i.e. the Police and the District Collectors, were asked to render all assistance to the authorities in implementing this order.

The Bench also made it clear that such of those units (falling within the remaining 1,020 units) which have applied for consent but in whose care no orders had been passed by the PCB also would not be permitted to continue till their applications for consent were decided.

Such of those units which had applied for renewal or consent in whose care and orders were not passed might continue and in the event of consent being refused, such units should be stopped and sealed forthwith until the pollution control laws were complied with by the said units. Their applications were directed to be disposed of by the PCB within two months.

The Bench made it clear that this order did not mean grant of permission to those units to continue the process within the distance of 1 km which aspect might be decided by the authorities in due course. It was still to be determined whether their standards were in conformity with the pollution control laws and whether they were entitled to renewal of consent or they were to shift the units beyond the prohibited distance.

The Bench said if the units which had applied for renewal did not satisfy the standards, steps might be taken to implement the environmental laws by refusing renewal or consent within two months.

Taking into account the enormity of the pollution, both water and environmental and the emphasis laid down by the Apex court on providing pollution-free atmosphere to the society, the Bench said that the National Environmental Engineering Research Institute (NEERI), Nagpur, should also be associated with the process and report whether the Effluent Treatment Plants (ETPs) installed by those industries which were allowed to operate, conformed to the standards or not. But mere submission of application would not enable the industries to continue functioning.

The Bench was of the view that the NEERI should also report about the steps to be taken to bring down pollution in conformity with the standards laid down in respect of each of the units.

Indian Spices Set to Gain More Access to US Kitchens

Rising per capita consumption of spices among Americans and the ability of Indian exporters to supply quality products are likely to dictate the course of Indian spices export to the United States.

In the context of a growing demand for natural flavouring, colouring and fragrance materials, there is tremendous scope for higher export for many of the spices now being exported to US.

However, the success of tapping this large and potential market would depend on the ability of Indian exporters to supply good quality spices in conformity with the standards of American Spice Trade Association and US Federal Drugs Administration.

Spice export from India to the US during 1997-98 was valued at Rs.424.69 crores against Rs.417.75 crores the previous year.

Despite the surge in value terms, the quantity exported fell to 42,344 tonnes from 46,872 tonnes shipped in 1996-97.

Apart from the traditional spices like black pepper, chillies, ginger, turmeric and coriander, value added spice products in the form of essential oils and oleoresins and mint oil were likely to find greater acceptance in US.

Value-added spices had an edge over the traditional spices due to the longer shelf-life and their resistance to microbial contamination.

Natural vanilla extract derived from cambodge was one of the new items which recently gained access to the Americans' kitchen.

Garlic News

The National Horticultural Research Development Foundation, Nashik has been working on the R & D development of garlic for the last so many years. They have provided information with regard to two varieties which have got lot of export potential.

The garlic variety "G-282" is now cultivated on large scale in Karnal, Ambala, Kurukshetra, Panipet, Haryana, Buudaun, Etah, Manipuri and Bareilly areas of U.P., Mandsaur, Indore, Ujjain and Ratlam areas of Madhya Pradesh. As per estimates about 27 hectares were brought under "G282" variety for multiplication in 1996-97 and produced about 5520 quintals for further use. A proposal is now under consideration for releasing this variety as "Yamuna Safed-3."

"G -313" garlic variety popularly known as Agrifound Parvati is widely grown in Kullu, Manali, Shimla, Sainj and Gadsa Valley of Himachal Pradesh and in Almora. Nainital, Ramgaryh areas in the hills of U.P. About 115 hectares are cultivated with this variety during 96-97 for multiplication and 8700 quintals are expected to be produced.

Blue Star Ties up with Four Multinationals

Blue Star, the refriegeration major has entered into manufacturing agreement with four multinationals for the manufacture of industrial-refrigeration equipment and package-refrigeration units. The four companies are York International Corporation, Climatrol of Italy, Kolpak of the US and Bohn of the US. The new manufacturing tie up includes technology transfer from the multinationals for which a royalty will be paid in each case, and Blue Star will also act as a source-base for various product requirements of these companies for their markets overseas.

The venture with york International Corporation will upgrade product technology for the currently manufactured range and to produce a new range of air-cooled and water-cooled screw-packaged chillers as well as of a new range of industrial-refrigeration equipment.

Blue Star will also manufacture these new products for its markets in West Asia and the Far East. The refrigerating unit needed for cold rooms will now be manufactured through a manufacturing tie up with BOHN (Heatcraft) of USA

The company has already launched new range of mini-splits, ducted-splits and packaged air-conditioning units, in association with Rheem Manufacturing company of the USA.

Monsanto to Restructure Operation

Monsanto, the US multinational is proposing to demerge its industrial chemicals business into separate company—Solutia, as part of its restructuring exercise. Worldwide, the company has demerged its chemicals business into two separately traded companies — a life-sciences firm which includes agricultural, food ingredient and pharma business and a chemicals entity.

The industrial-chemicals business, accounting for about 10 per cent of Monsanto Chemicals of India's turn over, will be spun off. The group currently operates in india through three copmpanies — Monsanto India Pvt Ltd (MIPL), Monsanto Enterprises (MEPL) and Monsanto Chemicals of India

(MCIL). Monsanto Chemicals formulates and markets weedicides for major brands include Roundup Machete and Avadex.

Solutia willoperate in the field of plastic inter layers for glass manufacturers for use in vehicle windows, windshields (Saflex) and heat exchange fluids.

CSIR Chief Stresses Importance of Intellectual Property Generation and Protection in India

Dr. R.A. Mashelkar, Director General, CSIR & Secretary, Department of Scientific and Industrial Research, stressed the importance of intellectual property generation and protection in India. He said that there was a great deal of "patent illiteracy" among scientists, industralists and even opinion makers.

Delivering the second Champakbhai Choksey Endowment Lecture instituted at Dwarkadas J. Sanghvi College of Engineering in Mumbai recently, Dr. Mashelkar said that recent debates on biopiracy, particularly on patents on tumeric, neem, basmati rice, etc, had evoked a strong public outcry. However, CSIR's victory on winning the turmeric case had shown India's ability to fight a 'rule-based war' on patents and win in the US patent office. Now the battle on basmati rice lies ahead. Dr. Mashelkar, in particular emphasised the need to launch a concerted effort on modernising the patent offices and sensitising the science and technology community on patents and also putting several acts, pending before the government (such as biodiversity conservation act, industrial designs act, trde mark act) in place. He said that India could become the "Intellectual Capital of the World" in the twenty first century, if it knows how to manage the intellectual property issues effectively.

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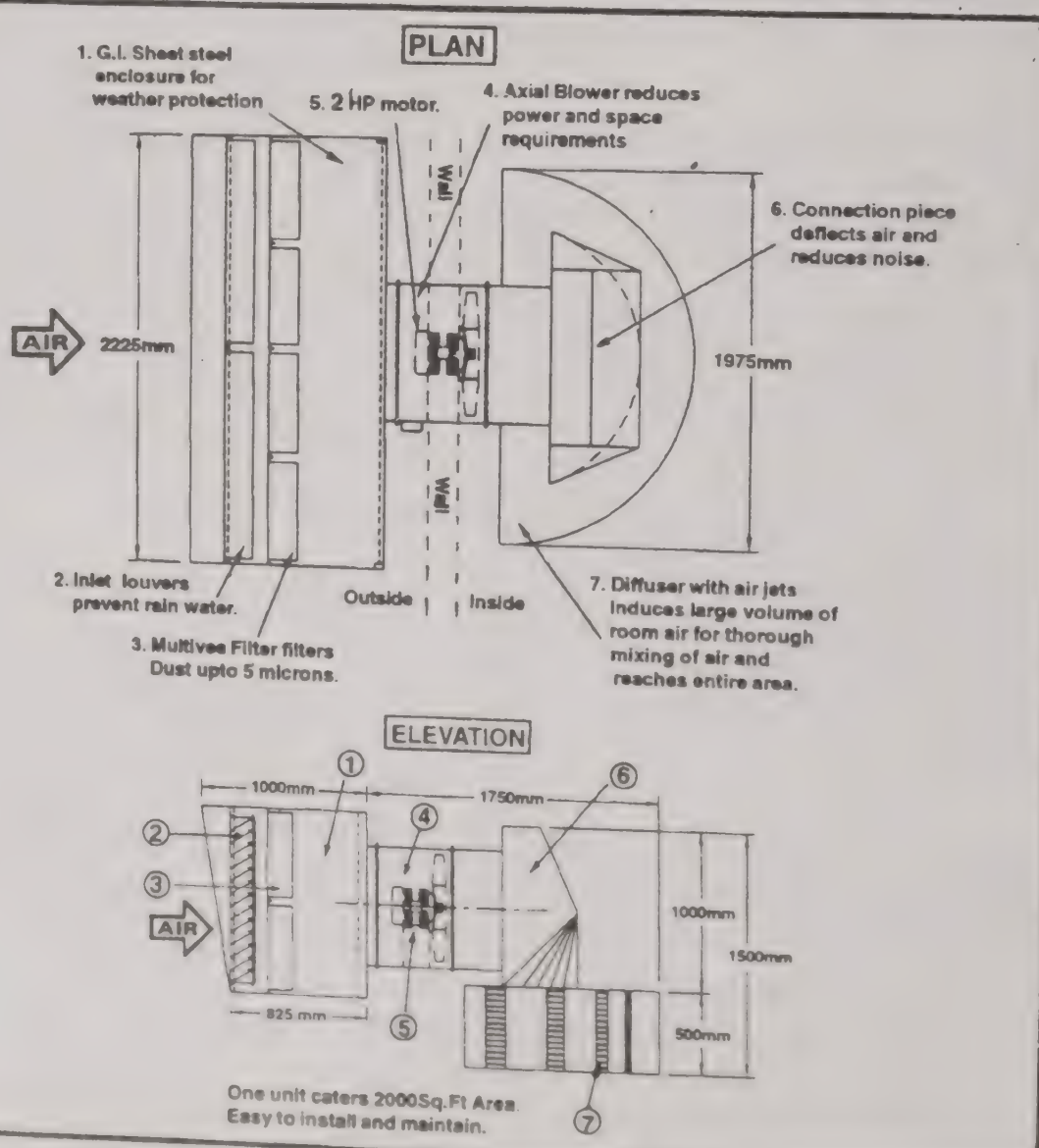

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Popcorn - What is it ?

Probiotics Feeding to Improve Poultry Meat Quality — A Critical Appraisal

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Introduction

As per the latest estimates, the present production of poultry meat in India is around 0.659 million tonnes which form 15.79 per cent of the total meat produced in the country. It is encouraging to note that the growth rate of broiler industry is 20 per cent per annum. Therefore, it is hoped that by the turn of century, percapita availability of poultry meat would increase to 987g from the present figure of 707g . However, we have still to go a long way to catch the average per capita consumption rate of the world as well as developed nations (Panda, 1997). Besides increase in production of poultry meat, emphasis is being laid on development of further processed products (Sahoo *et al.*, 1996) with the rapid socio-economic changes, increase in percapita income and growth of fast food industry especially in urban areas.

Poultry are genetically selected to achieve higher growth rate, better feed conversion efficiency and less mortality within the shortest possible time (6-8 weeks). Public disapproval and banning of antibiotics and growth hormones as feed additives (due to their residual effects in meat) in certain parts of the world has renewed commercial interest in probiotics production and its use in poultry feeding (Hose and Sozzi, 1991) as these are neither absorbed in the gut nor do they reach the general circulation i.e., without residual effect in meat (Dhingra, 1993). The term 'probiotics' is applied to a group of bacteria belonging to *Lactobacilus* in general and *L. acidophilus* in particular. Probiotics may be defined as a cultural product or live microbial feed supplement which has beneficial effect upon the host animal by improving its intestinal balance between the beneficial bacteria and the harmful bacteria (Hose and Sozzi, 1991).

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Probiotic is a live microbial feed supplement which improves the intestinal microbial balance in favour of the host animal.

Various aspects of probiotics and their use in improving growth of poultry and meat quality are discussed below.

Definition and Composition of Probiotics

The word "Probiotics" was coined by Parker (1974) which means 'for life' or 'supporting life'. First of all, Metchnikoff (1907) gave the idea that ingestion of beneficial microbes might reduce the ill effects produced by detrimental putrefactive microbes in the gastrointestinal tract of human beings and animals. Parker (1974) defined probiotics as organisms and substances which contribute to intestinal microbial balance. Probiotic is a live microbial feed supplement which improves the intestinal microbial balance in favour of the host animal. (Fuller, 1989). It is comprised of viable microbial cultures or fermented products (Fox, 1988; Pollmann, 1992).

The United States Food and Drug Administration (FDA) suggested that manufacturers should use the term direct-fed microbial (DFM) instead of probiotics. According to FDA, DFM means 'a source of live (viable) naturally occurring microorganisms' (Pendelton, 1992). At present, microorganisms which are being used as DFM come under the category classified by FDA and the Association of American Feed Control Officials (AAFCO) as generally recognised as safe (GRAS) ingredients. Havenaar and Huis in't Veld (1992) stated probiotic as a single or mixed culture of live microorganisms when supplied to animal or

man, affect the host beneficially by improving the properties of the naturally occurring microflora.

Lactic acid producing bacteria have been commonly used as probiotics since long. Around one to eight strains may be used in a probiotic preparation (Fuller,1989). Most commonly, a single strain and occasionally two or more strains to different genera are being used in a probiotic preparation (Raibaud and Raynaud, 1990). Multiple-strain preparations are active against a wider range of conditions and animal species. These have been extensively used for the control of *Salmonella* in poultry (Mead, 1991).

At times, bacterial spores, which usually resist stomach acidity and germinate in the upper intestinal tract have also been employed. These include strain from the *Lactobacilllus sporogenes* (Koide, 1992; Tobey, 1992; Kumar and Lakshminarayan, 1997).

About 42 different microbes have been reported under GRAS and are used as DFM (AAFCO, 1993), but most often used are species of lactobacilli (*L. Acidophilus, L. bulgaricus, L.casei, L. helveticus, L. lactis, L. plantarum, L. salivarius), Streptococcus thermophilus. Entrococcus faecium, E. faecalis, Bifidobacterium* spp. and *E. coli* (Fuller, 1989). *Lactobacillus bulgaricus* and *Streptococcus thermophilus* are yoghurt starter organisms, whereas all others are derived from intestinal strains.

Probiotics commercially available contain strains of genera *Lactobacillus* (mainly), *Bifidobacterium, Streptococcus, Bacillus, Bacteroides, Pediococcus, Leuconostoc, Propionibacterium* (Llyod-Evans, 1989; Tobey, 1992; Mantere-Alhonen, 1995), *Saccharomyces cerevisiae and Aspergillus oryzae* (Verma and Singh, 1995). Probiotics for poultry have been divided as per their site of colonization and desired more of action. *Lactobacilli* colonize in the crop having effect on nutritional and performances parameters, whereas mixtures of undefined or defined intestinal cultures in the caecum against pathogens (Barrow, 1992) include mono and multigeneric products (upto 65 strains) which are being used in experiments for control of *Salmonella* in poultry (Mead, 1991; Corrier *et al.*, 1993).

Probiotics come under the category classified by FDA and the Association of American Feed Control Officials (AAFCO) as generally recognised as safe (GRAS) ingredients.

Selection Criteria for Probiotics

As per Freter (1992), very little is known about how the microbes in probiotics associate with gut mucosa, exert beneficial physiological effect or work against unwanted microorganisms in the intestine.

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Therefore, the set of proposed criteria for an effective probiotic is very arbittary. Havenaar *et al.* (1992a) reviewed the general criteria used for the selection of microbial strains (bacteria, fungi and yeasts) for probiotic use which included origin of the strain, viability during processing and storage, resistance to *in vivo* and *in vitro* conditions, adherence including colonization and antimicrobial activity. Besides these, biological safety during production and processing, the mode of administering the probiotic and the location on/in the body where the microorganisms of the probiotic must be active are also to be kept in mind.

Fuller (1992) advocated that an effective probiotic should be capable of being produced as a viable preparation on an industrial scale, remain stable and viable in field conditions, have the ability to survive (not necessarily grow) in the intestine and produce the desired beneficial effect in the host animal. As per Chesson (1993), strains used should be of gut origin (or able to tolerate conditions existing in digestive tract), have strong adherent qualities independent of metabolic activity or viability, have a capacity to revitalize rapidly under gut conditions after lyophilization, be capable of producing compounds antagonistic to pathogens and have a capacity to stimulate the cell-mediated immune response.

The regulatory agencies in most countries do not allow the use of undefined preparations in commercial poultry production (Stavric and D'Aoust, 1993). Therefore, attempts have been made to isolate and identify strains from caecal microflora and prepare mixtures of defined cultures. Some researchers have gone to the extent of selecting isolates of all major groups of caecal bacteria (Impey *et al.*, 1982, Stavric *et al.*, 1985). Others have identified only lactobacilli because of their capacity to adhere to the epithelial cells of the crop (Nurmi

et al. 1983). Caecal isolates replicate in an acidic medium, have constant generation times, utilise lactose and produce specific short chain volatile fatty acids (VFA), but their efficacy depends on the presence of lactose in the chicks' diet (Corrier *et al.*, 1993).

Lactobacilli isolated from animals other than birds failed to adhere to chicken crop cells *in vitro* (Fuller, 1977). However, a close correlation between attachment *in vitro* and colonization of germ-free chickens was obtained with several avian strains, indicating host specificity (Fuller, 1978). It has been observed that some of the required properties change upon storage and by laboratory manipulations. Loss of the adhesive property or capacity to produce bacteriocin-like compounds has been found with *Lactobacilli* (Conway, 1989). Similarly, mixtures of defined cultures can lose their effectiveness in reducing *Salmonella* in chicks depending upon storage time and frequency of transfer (Gleeson *et al.*, 1989; Stavric, 1992). With probiotics used for therapeutic and/ or growth promoting purposes, the dosage and the frequency of administration vary. Only one dose is required either in the hatchery or in the first drinking water for prevention of colonization of *Salmonella* in poultry (Pivnic and Nurmi, 1982) while for growth promotion, a minimum effective dosage of approximately 10^6 to 10^7 cfu g^{-1} of feed are administered daily for at least one to two months (Tournut, 1989).

Mechanism of Action for Probiotics

Researchers have proposed different mechanisms of action for probiotics. The mechanism of the probiotic effect might be due to competition for adhesion receptors on the gut epithelium (Jonson and Conway, 1992), competition for nutrients (Freter, 1992), production of antibacterial substances (Hentges, 1992) and stimulation of immune system (Perdigon and Alvarez, 1992). However, complex interactions are likely to occur in practice.

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Competition for Adhesion Receptors on the Gut Epithelium

Research carried out earlier provided evidence to believe that the indigenous gut microflora have the ability to inhibit colonization of invading microorganisms in poultry and germ-free or antibiotic-treated experimental animals (Hentges, 1992). The classical example is newly hatched chicks from commercial hatcheries, in which growth of a native microflora is delayed, when gut microflora from adult healthy birds is administered to them, they become resistant to infection when subsequently challenged with food poisoning *salmonellae* (Nurmi and Rantala, 1973). This inhibition process is known as the 'Nurmi concept' or 'competitive exclusion' (CE). Most often, mechanism(s) cited in CE are competition between existing microflora and pathogen for adherence on intestinal mucosa and the production of volatile fatty acids (VFA) (Pivnic and Nurmi, 1982). Indirect evidence for such competition was derived from experiments where homogenates of washed caeca collected from chicks treated with native microflora, had markedly reduced the numbers of *Salmonella* or *E. coli* than control chicks and the protective microflora adhered to the caecal wall (Soerjadi *et al.*, 1982; Stavric *et al.*, 1987).

Certain inhibitory metabolites produced by *Lactobacillus* spp. include well characterized bacteriocins (acidolin, bulgaricin, nisin, reuterin), bacteriocin-like substances and other antagonists such as hydrogen peroxide and certain organic acid

Competition for Nutrients

The hypothesis of competition for nutrients in the gut lumen between indigenous and invading bacteria was derived from observations that bacteria in a continuous flow culture compete for nutrients. However, little information is available to provide evidence for such a competition operating in the intestine (Freter, 1992, Hentges, 1992). Jonsson and Conway (1992) stated that *in vivo* colonization of a site in the gastrointestinal mucosa involved many more aspects than simply adhesion to the epithelium. Lactic acid bacteria growing at the site of colonization might utilize nutrients that would otherwise be available for pathogens and/or produce metabolites which indirectly would inhibit the growth of pathogens.

Production of Antibacterial Substances

Certain inhibitory metabolites produced by *Lactobacillus* spp. include well characterized bacteriocins (acidolin, bulgaricin, nisin, reuterin), bacteriocin-like substances and other antagonists such as hydrogen peroxide and certain

organic acids) (Juven *et al., 1991).* Viable lactobacilli were usually not effective in reducing *Salmonella* colonization in poultry, whereas the metabolites produced were active *in vitro* against a wide range of bacterial species (Juven *et al.,* 1991; Havenaar *et al.,* 1992b). Some bacteriocins inhibited only Gram-positive bacteria, while acidolin inhibited some Gram-positive and Gram-negative species and reuterin inhibited all bacteria, yeast and fungi tested (Havenaar *et al.,* 1992b). The role of such antagonistic metabolites in the gut is largely unknown because there have not been complementary *in vivo* and *in vitro* studies (Conway, 1989). Further, only few isolates of *Lactobacillus* showed antibacterial activity due to the production of bacteriocin-like substances (Sarkar and Banerjee, 1996).

Organic acids (lactic, acetic, butyric and propionic) generated by facultative and obligatory anaerobes, in undissociated form, possess the ability to reduce intestinal pH. Lactic and acetic acid producing bacteria (*Lactobacillus, Enterococcus and Bifidobacterium)* have been most often used as probiotics. *Veillonella* spp., which produce acetic and propionic acids, have shown some promise while using against pathogens (Szylit*et al.,* 1988; Hinton *et al.,* 1991). Volatile fatty acids (VFA) are generated in the caeca of chicks by about the second week after hatching (Pivnic and Nurmi, 1982). VFA in their undissociated form have the greatest antibacterial activity (Meynell, 1963; Bonhoff *et. al.,* 1964), because it reduces the pH of upper gut (Fuller, 1977, Morishita *et al.,* 1982). The protective effect of VFA against *Salmonella* was further confirmed (Corrier *et al.,* 1993).

Stimulation of Immune System

Immune protection in poultry is mainly in the egg yolk which discharges its antibodies directly into the gut lumen and assures protection of the young bird against infections during the first four days after hatching (Schat and Myers, 1991). The role of the immune response in controlling components of the intestinal flora in poultry is little understood (Barrow, 1992). Maternal antibody IgG passively acquired in the developing chicken, usually does not offer significant protection against *Salmonella* (Spencer, 1992). Further, the immune mechanism appeared to have little influence on early intestinal colonization. The observation that conventional animals and birds equipped with complete microflora had higher immunoglobulin levels and phagocytic activity than their germ-free counterparts, provide an indication that probiotics could increase immunity (Nousiainen and Setala, 1993). Perdigon *et. al.* (1993) reported actual activation of the mucosal intestinal immunity in mice was produced against enteropathogens with lactobacilli.

Probiotics significantly increase body weight gain, feed efficiency ratio, carcass characteristics and help to reduce the rate of mortality of broilers.

Factors Affecting Efficacy of Probiotics

Interaction with Other Additives, Nutrients and Types of Ingredients

Probiotics are usually considered as 'natural' substitutes for feed antibiotics. Based on earlier studies, it might be feasible to combine the probiotic and antibiotic treatments to obtain an additive advantage. Nousiainen and Setala (1993) suggested that the natural microflora resist the invasion of both harmful and probiotic bacteria. Therefore, the probiotic bacteria may be established more easily in the gastrointestinal tract of target animals if the natural flora is weakened by the use of an antibacterial feed additive.

The use of fructooligosaccharides (FOS) in poultry appears more promising. Addition of 0.25% and 0.50% FOS to broiler diets improved feed efficiency and reduced air sac lesions (Ammerman *et al.,* 1988), improved body weight gain and reduced level of *Salmonella* when broilers were fed with 0.375 per cent FOS in their diet (Izat *et al.,* 1990) and improved body weight gain, feed efficiency and carcass yield (Speights, 1990).

Data concerning the influence of feed composition on probiotic action in poultry are limited. Chicks fed with a *Lactobacillus* preparation in combination with sub-optimal amino acid levels (methionine, cysteine and lysine were restricted to 90 per cent of the control) had a growth rate equal to that of chicks fed with the control diet without the probiotic (Dilworth and Day, 1978). Supplementation of whey in a diet of turkey poults enhanced the effect of *L. reuteri* by increasing body weight gain and resistance to *Salmonellae.*(Edens *et al.,* 1991).

The effect of antibiotics in comparison or in combination with probiotics varied depending on the nature of the antibiotic. In some cases, gain and feed efficiency in broilers (Tortuero, 1973; McNaughton *et al.,* 1992). A probiotic containing *Bacillus* sp. hardly interfered with the action of anticoccidial drugs in broilers (Saylor *at al.,* 1993). Interactions of some antibiotics, anticoccidials and carbohydrates with CE cultures have been observed. The effectiveness of CE treatments was dependent on the type of additive and the method of administration to the chicks (Stavric and D'Aoust, 1993). Jones and Poorman (1994) demonstrated that lactic acid bacteria in certain direct-fed microbial (DFM) products are able to withstand the

commercial pelleting process (a conditioning temperature of 80°C for about 30 sec and cooled in a horizontal pellet cooler). El-Nezami *et al.,* (1996) reported that 1 g of *Lactobacillus rhamnosus* GG was capable of binding > 95 per cent of aflatoxin B_1 and responsible for biological control of food carcinogens.

Housing and Environment

Stress greatly affects the poultry production. Broilers reared at extreme temperature exhibited changes in gut microflora and depressed body weight gain and feed efficiency. However, the effect on these parameters was not significant when the diet contained strains of *Lactobacillus* or *Bifidobacterium* (Suzuki *at al.,* 1989). A significant reduction in *Salmonella* contamination during transport of seven week-old broilers was achieved by incorporating a commercial *Lactobacillus* preparation in their feed and water for one week prior to the transport (Jones, 1992). The success of CE culture for reduction of *Salmonellae* in commercial poultry also has been found to be critically dependent on the farm environment. Strict hygienic measures in poultry production, routinely used in the Scandinavian countries could have contributed to the consistent efficacy of CE culture for elimination of *Salmonella* spp. in these countries (Wierup *et al.,* 1988). On the other hand, in trials where hygienic measures were not strictly followed, the competitive exclusion culture treatment was not much effective (Humbert *et al.,* 1992).

Effect of Probiotics on Gastrointestinal Tract

Fuller (1973) demonstrated that the attachment of lactobacilli to the epithelial lining of crop maintains these in a numerically dominant position and prevents the unrestricted growth of *E. coli* due to the low pH produced in the crop. Tortuero (1973) found a reduction in caecal and intestinal microflora in broilers and Leghorn chicks when *Lactobacillus acidophilus* was administered in water. The number of other microbes of the feed in which *L. acidophilus* added was also reduced. Nurmi and Rantala (1973) observed that 69-77 per cent of chicks fed with gut contents (ingesta) from adult cocks remained free from *Salmonella infantis* when challenged with this organism, whereas 100 per cent chicks belonging to control group were found to be carriers of *S. infantis.*

It was found that chicks and poults gained substantial resistance to *S. typhimurium* if dosed orally either with the intestinal contents from adult turkey and chicken or anaerobic cultures of faeces from old chicken. The results indicated that caecal contents offered greater protection than contents of other areas of the gastro-intestinal tract (Reid and Barnum, 1983; Anderson *et al.,* 1984).

Weinack *et al.,* (1982) found that a reciprocal protection was provided by native chicken and turkey intestinal microflora in chicks and poults against *S. typhimurium* and pathogenic strain of *E. coli.* Protection against *E. coli* was somewhat greater in chicken than in turkey. Watkins and Miller (1983a,b) reported that prophylactic as well as therapeutic treatment of gnotobiotic chicks with *L. acidophilus* significantly reduced shedding of pathogens *S. typhimurium* and *S. aureus.* The above authors in another trial demonstrated that *L. acidophilus* was associated with epithelium of crop, proventriculus and duodenum of chicks and this attachment increased its competitiveness with other bacteria for colonizing the gut and reduced binding sites for other bacteria in the crop. Han *et al.,* (1984) observed that *Lactobacillus sporogenes* had growth promoting effect in birds due to production of lactic acid in gastro-intestinal tract.

Seuna *et al.,* (1985) found that the bacterial culture (Nurmi culture) was more effective against *Salmonella haldar* infection in turkey poults than gentamycin treatment. Nurmi culture alongwith gentamycin reduced number of shedding birds but a higher proportion of birds was seen to become carrier, compared with the groups given Nurmi culture alone.

A preparation of chicken or turkey intestinal bacteria administered to broiler chicks and poults could protect them against a challenge with viable cells of *Salmonella* (Schenetz, 1992; Nuotio *at al.,* 1992; Richard and John, 1993). The treatment effectively prevented colonisation in caecum by these bacteria. They further observed that liver, heart and spleen remained free from *Salmonella* by this treatment. Vandevoorde *et al.,* (1991) demonstrated *in vitro* the antagonism of lactobacilli against Enterobacteriacae and *S. typhimurium* and attributed this to lactic acid production by lactobacilli which adhere to the crop epithelium in the chicken gut.

Hollister *et al.,* (1992) and Nisbet *et al.,* (1992) supplied day old broiler chicks and poults orally with caecal microorganisms maintained in continuous flow culture followed by a challenge with 10^4 cfu of *Salmonella* at 3 days age. At the age of 10 to 20 days, probiotic reduced caecal colonisation of *Salmonella* and this colonisation was further reduced when 5 per cent lactose was supplemented. Similar results were also observed by Corrier *et al.,* (1992), Corrier *et al.,* (1993) and Ziprin and Deloach (1993).

Broiler chicks were orally supplied with *S. typhimurium* either at one and two days age followed by treatment with probiotic (a mixture of *S. faecium* and *L. acidophilus)* alone or in combination with some soluble complex carbohydrates in

the feed (Conner and Moran Jr., 1992). Combination of probiotic and additives failed to lower the number of *Salmonella* in the caeca but probiotic alone lowered the number of *Salmonella* in the caeca from log 3.16 to 1.04 cfu/g. Mishra and Acharya (1992) concluded that lactisyn (a lyophilized culture of strains of family Lactobacillaceae) could be used for control of *Salmonellosis* in a sub-clinical stage.

A substantial amount of evidence exists concerning the efficacy of competitive exclusion (CE) bacterial cultues for reduction of food poisoning *Salmonella* in poultry (Mead and Impey, 1987; Stavric and D'Aoust, 1993). Undefined CE cultures derived from chicken intestinal flora consistently protected chicks and turkey poults against challenges with upto 10^6 cfu of different serotypes of *Salmonella* (Stavric and D'Aoust, 1993). Protection was also obtained in several species of *Salmonella* - infected mature birds that had been treated with antibiotics prior to CE treatment (Mead, 1991). The efficacy of CE culture against repeated challenges of naturally occurring *Salmonella* in commercial poultry production has not been consistent. However, a substantial reduction of *Salmonella* has been observed in most field trials, particularly when there was strict adherence to hygienic measures (Stavric and D'Aoust, 1993).

Effect of Probiotics on Growth, Feed Efficiency, Mortality and Carcass Quality

Dilworth and Day (1978) observed significant improvement in growth and feed efficiency in broilers fed with different graded levels of *Lactobacillus* culture. In another trial, a saving of amino acids (lysine and methionine + cystine) to the extent of 10 per cent in diet without affecting growth rate and feed efficiency was observed. Similar results were obtained by Couch (1978) who found decreased mortality and reduced feed cost per pound of meat production. Arends (1981) conducted four trials in 3 lakh broilers at three different places to see the influence of feeding *L. acidophilus* on their performance and observed better feed conversion and improved weight gain. Watkins and Miller (1983 a, b) observed that prophylactic as well as therapeutic treatment of gnotobiotic chicks with *L. acidophilus* significantly reduced chick mortality.

On the contrary, Watkins and Kratzer (1984) reported that body weight of broiler chicks, fed pure culture of *Lactobacillus* daily or on alternate days did not change upto marketing age. No significant differences were found in feed conversion. Fethiere and Miles (1988) observed that feeding *L. acidophilus* and other lactobacilli did not affect body weight and feed conversion efficiency of broiler chicks.

Early application of lactic acid bacteria greatly reduced early mortality, improved feed conversion and rate of weight gain in broilers (Barnes, 1987; Sharma, 1988). Wiseman (1990) observed that broilers supplemented with probiotic and yeast showed low feed intake, better feed conversion ratio and gain in weight. Kim *et al.* (1990) reported that feed intake and weight gain of broilers given probiotic with moldy maize increased significantly and the response to supplementation with probiotics might be greater in the moldy maize diets than in fresh maize diets. Guillot and Yvore (1991) reported a growth promoting effect on chicken with probiotic *Bacillus.*

Buche *et al.*, (1992) and Kalbande *et al.*, (1992) reported that lower concentration of probiotic (0.02%) in the diet of broilers had a significant positive effect on 8 week body weight and feed conversion ratio. The higher level of probiotic (0.04%) alone or in combination with nitrofuran did neither improve growth rate nor feed conversion efficiency. Takalikar *et al.*, (1992 a,b) observed that *'Lactobacillus* spores powder' supplemented diets resulted in superior carcass characteristics of broilers such as shrinkage, dressed yield, eviscerated yield, giblets and edible meat yield but when 'Poultry farmore' provided in feed, no significant effect on carcass characteristics was noticed.

Verma (1992) observed that lactic acid bacteria improved growth and feed conversion efficiency in broilers. Initial loss due to mortality in broilers suffering from colisepticemia was compensated in terms of significantly better growth, feed conversion efficiency and lower rate of mortality on feeding probiotic (Biospur @ 0.05%) (Moses, 1992) and on feeding giprobiotic (Dhande *et al.*, 1993). On the other hand, Novelli (1993) reported that mean live weight and feed conversion efficiency were unaffected in probiotic fed broilers.

Mudalgi *et al.*, (1993) noticed that two lactobacilli (*L. acidophilus* and *L. bulgaricus)* cultures feeding in broilers numerically improved weight gains with no significant benefit on feed intake or feed conversion efficiency. A slightly better utilisation of nutrients like N, Ca, P, ether extract and growth energy were seen. Mishra *et al.*, (1994) fed *Lactobacillus,* isolated from the intestinal tract of poultry, to broiler chicks and observed significantly higher weight gains at 6, 7, and 8 weeks of age.

Taklimi *et al.*, (1994) conducted a biological trial to study the viability of live yeast (*Saccharomyces cerevisiae* [1026]) in broilers fed diet containing 0.1 per cent lie yeast ($5x10^9$/g) for a duration of 35 days. The crop contents showed highest viable yeast cells ($8x10^5$/g), followed by gizzard ($5x10^5$/g), small intestine ($2.4x10^5$/g) and caeca ($7x10^3$/g), It was concluded that yeast can sur-

vive in the digestive tract of chicken, thus improving the growth performance.

Samanta and Biswas (1995) reported that probiotic as well as lactic acid feeding did not produce any significant effect on the growth performance of broiler chicks. No mortality was observed in probiotic fed groups, whereas it was 4.2 per cent in lactic acid fed group and 8.3 per cent in control group. Durst *et al.*, (1995) observed that supplementation of broiler diet with *Saccharomyces cerevisiae* improved average daily weight gain from 2.4 to 3.8 per cent. Differences were not significant. Feed conversion efficiency and weight of the carcass were not different among groups. Liver weight showed a significant increase in the lowest supplementation group. Bhatt *et al.*, (1995) reported that out of four strains (L_1 to L_4) of *Lactobacillus bulgaricus*, only one strain (L_4) was effective in stimulating broiler growth and reducing mortality over the control groups, but showed non-significantly superior feed efficiency ratio.

Mohan *et al.*, (1996) noticed that probiotic plus antibiotic-supplemented group of birds had a maximum weight gain (1148.5g) followed by antibiotics (1141.3 g), probiotic-supplemented (1128.4 g) and control birds (1045.6 g) after 6 weeks. Jin *et al.*, (1996) reported that weight gain of chickens fed with *Bacillus subtilis* and *Lactobacillus* was higher ($P \leq 0.05$) than the control. There was a tendency towards a higher feed: gain ratio in the control group and those given *Lactobacillus* in drinking water but those fed *Lactobacillus* in feed had a lower ($P \leq 0.05$) feed: gain ratio. Singh and Sharma (1996) carried out an investigation in broiler chicks during summer season using probiotic (*L. sporogenes).* They observed higher weight gain, better feed efficiency and concluded that the use of 0.02% *L. sporogenes* is optimum for better performance of broiler chicks. Megharaja *et al.*, (1996) observed higher body weight, feed consumption and reduced mortality by supplementary feeding of *Saccharomyces cerevisiae* and *L. sporogenes* in broilers. Field trials were carried out by Sharma and Katoch (1996) using different combinations of selected microbes in broilers. According to them, a combination of *L. bulgaricus, Streptococcus lactis* and *Saccharomyces cerevisiae* gave higher growth rate of reduced chick mortality. Verma and Agarwal (1996) indicated that diet supplementation with live yeast culture (0.1%) during summer resulted in higher body weight, better feed efficiency and reduced mortality. Ramamurthy *et al.*, (1996) stated that in winter, the body weight, feed efficiency and livability were comparatively better than in summer.

Recently, Mahajan (1998) studied the effect of probiotics on the growth, feed efficiency and carcass quality of broilers. It was observed that the body weight gain, feed consumption and feed conversion ratio on cumulative basis were significantly ($P \leq 0.05$) higher and per cent cumulative mortality was lower in probiotic (Lacto-Sacc @ 0.025%) fed broilers as compared to control. It was also noticed that the per cent yield of dressing, meaty cut up parts and meat:bone ratio of all cuts were significantly higher with better grade carcasses in the probiotic fed group.

Effect of Probiotics on Poultry Meat and Its Products Quality

Little information is available on the aspects of the effect of probiotics feeding on the quality of poultry meat and its products. A study was conducted (Mahajan, 1998) on the above aspects and it was observed that moisture, protein, ash, water holding capacity, emulsion stability and emulsifying capacity were significantly ($P \leq 0.05$) higher, whereas fat, moisture: protein ratio, pH, shear press and microbial counts were significantly ($P \leq 0.05$) lower for the meat of Lacto-Sacc fed broilers. Organoleptic score for overall acceptability was significantly higher in chicken meat balls prepared from the probiotic-fed group. Chicken meat balls were acceptable till 14 days during refrigerated storage.

Conclusions

To meet the health conscious meat consumers demand, the use of probiotics in improving the quality of poultry meat and meat products is one of the most important research areas. The user should know what is probiotic and what are the selection criteria for it. The mechanisms of the effect of probiotics in reducing the number of harmful bacteria, especially pathogens in the intestinal tract are known to a great extent. Probiotics significantly increase body weight gain, feed efficiency ratio, carcass characteristics and help to reduce the rate of mortality of broilers. Published data are almost silent regarding the effect of probiotics on the physico-chemical, microbiological and sensory quality of the poultry meat and its products. Therefore, concerted further research works are desired in these lacking areas to boost the development of further processed poultry products, thus giving a boost to our national economy.

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Probiotic Yoghurt for Infant Feeding

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Introduction

Breast milk is considered superior over other modified milk formulas due to its inherent properties and advantages (Jelliffe, 1975, Baggott., 1975). Technological innovations made in the commercial infant milk powder have not been able to meet the critical nutritional and physiological needs of infants (Thompkinson and Mathur, 1995). In the absence of nutritionally competent infant foods and inadequate production of breast milk, cultured milk products could be a suitable and practical substitute for infants owing to its nutritional and therapeutic properties. The various cultured milk products developed for infants have been reviewed by Sarkar and Mishra (1996).

Yoghurt, a cultured milk product is generally fermented with a mixture of two species, *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococus thermophilus*. In recent years, yoghurt has become a popular vehicle for incorporating the probiotic species, *Lactobacillus acidophilus* (Hull *et al.*, 1984) and *Bifidobacterium bifidum* (Holcomb *et al.*, 1991). Yoghurt being capable of restoring the normal lactic intestinal flora and inhibiting undesirable proteolytic organisms has been recommended for infant nutrition (Deodhar, 1984). Yoghurt could be used for infant feeding owing to its higher calcium content in protein and higher calcium/sodium ratio as compared to Recommended Dietary Allowance value for infants in USA (Demott, 1985). Recently, the authors have made an attempt to develop probiotic yoghurt containing probiotic culture like *Bifidobacterium bifidum* and other beneficial culture such as *Propionibacterium freudenreichii* subsp. *shermanii* for feeding infants and children.

Yoghurt, a cultured milk product is generally fermented with a mixture of two species, *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus*.

Dietetic Characteristics of Cultures

Dietetic characteristics of yoghurt cultures, *B. bifidum* and *P. freudenreichii* subsp. *shermanii* which led to suggestions for their use as dietary supplements are highlighted below:

Presence of β-D-galactosidase activity in probiotic yoghurt indicates its suitability for lactose-intolerant infants.

- Yoghurt cultures (Goodenough and Kleyn, 1976) and *B. bifidum* (Misra and Kuila, 1994) are known to retain its viability through the digestive tract and thus affords a means of implantation in the intestine.

- *L. delbrueckii* subsp. *bulgaricus* and *S. thermophilus* are reported to produce substances, inhibitory to pathogens, the former organism being considerably stronger than the latter (Mel'nikova and Koreleva, 1974). Elaboration of bacteriocins or bacteriocin like compounds such as bifidin by *B. bifidum* (Anand *et. al.*, 1984) and microgard™ by *P. freudenreichii* subsp. *shermanii* (Al-Zoreky *et al.*, 1993) proved to be inhibitory towards undesirable micro-organisms of public health. Inhibition of coliforms, *Bacillus cereus*, *Shigella dysenteriae* and *Salmonella typhimurium* by antimicrobials elaborated by mixed cultures of yoghurt organisms, *B. bifidum* and *P. freudenreichii* subsp. *shermanii* have been observed by the authors.

- Synthesis of niacin, folic acid (Reddy *et al.*, 1976) and vitamin B_{12} (Kanko *et al.*, 1986) by yoghurt cultures, vitamin B_1, B_6, folic acid by *B. bifidum* (Liebscher, 1961, Hamada, 1966) and thiamine, vitamins B_6, B_{12} and nicotinic acid by *P. freudenreichii* subsp. *shermanii* (Skupin *et al.*, 1974) induce an improvement in the nutritional qualities of cultured milks.

- Fermented milk containing both D(+) and D(-) lactic acid and both isomers improved the digestibility of casein and retention of calcium in the intenstine (Krusch, 1976). Ballabriga *et al.*, (1970) suggested that infants should be given only L(+) lactic acid to prevent acidosis. Yoghurt is reported to contain

47-60% L (+) lactic acid (Krusch, 1978). However, in bifidobacteria-based fermented milks, the amount of desired L(+) lactic acid dominated to a level of 90% (Klupsch, 1988). Therefore, milk cultured with these cultures would be safe for infant feeding.

- Proteolytic activity has been demonstrated by yoghurt cultures (Sarkar and Misra, 1994), *B. bifidum* (Misra and Kuila, 1991) and *P. freudenreichii* subsp. *shermanii* (Brendehaug and Langsrud, 1985). Proteolysis induces an increase in free amino acid content (Rasic *et al.*, 1971), improves the digestibility of proteins (Breslaw and Kleyn, 1973) and absorption of calcium, phosphorus, magnesium and zinc (Schaafsma and Dekkar, 1987).

- Presence of galactosidase enzyme, responsible for hydrolyzing the naturally occurring (1-6) linked galactosidase in yoghurt cultures (Kolars *et al.*, 1984), *B. bifidum* (Premi *et al.*, 1972) and *P. freuden reichii* subsp. *shermanii* (Kujawaski *et al.*, 1990) have been reported. A decline in lactose content and an increase in lactose activity due to β-galactosidase activity of starter cultures make fermented milk more suitable for lactose-intolerant infants.

- Serum cholesterol levels are important from a public health standpoint because high levels are associated with a greater risk to cardiovascular disease. Hypocholesterolemic effect in yoghurt cultures (Bazzarre *et al.*, 1983) and *Bifidobacteria* (Homma, 1988) have been registered. Deeth and Tamime (1981) reported hypocholesterolemic effect of yoghurt is either due to presence of heatstable enzyme system or a bacterial metabolite which is not present or present in low levels in milk.

Manufacture of Probiotic Yoghurt

A schematic diagram conceptualizing the procedure employed for the manufacture of probiotic yoghurt is shown in Fig. 1.

Formulated milk was obtained by fortifying standardized cow milk (2.5% fat, 10.46% S.N.F.) with 500 IU vitamin A, 80 IU vitamin D and 750 mg vitamin E. Milk was sweetened by admixturing 12% sucrose as suggested by Misra and Kuila (1992). The milk was then heat-treated at 95°C./30 min and cooled to 42 ±1°C, for starter inoculation. Yoghurt-YH-3, *B. bifidum* NDRI and *P. freudenreichii* subsp. *shermanii* MTCC 1371 were inoculated at 1% level, individually and incubated at 42 ±1°C. for 4 h to obtain probiotic yoghurt. Probiotic yoghurt retained all its desirable properties upto 7 days of storage at 8 ±1°C.

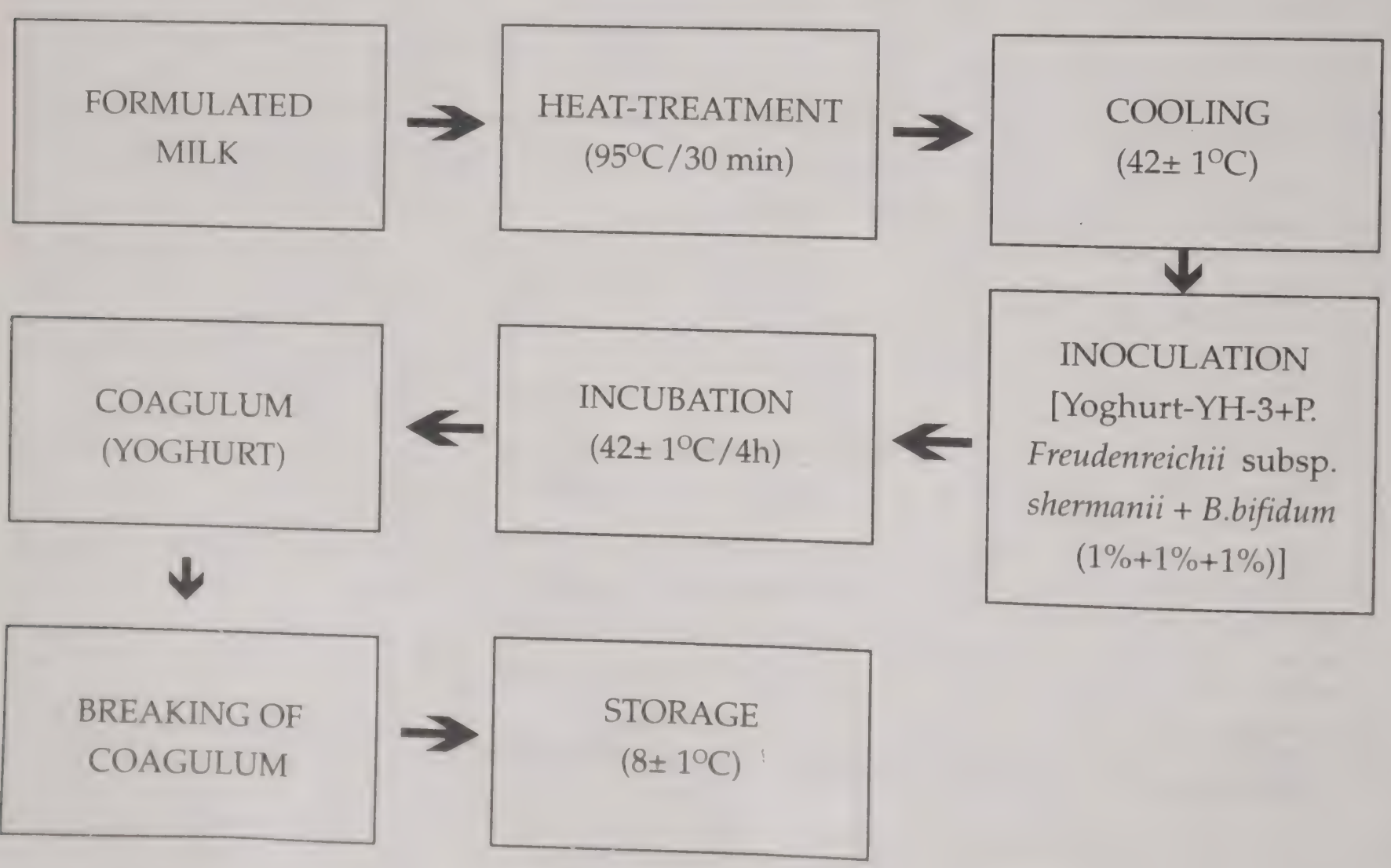

Fig.1. Schematic diagram for the manufacture of probiotic yoghurt

Chemical and Technological Characteristics

Freshly prepared probiotic yoghurt had 2.33% fat, 4.53% protein, 8.14% carbohydrates, 0.63% ash and 0.612% titratable acidity. The diacetyl and acetoin contents along with the volatile acids contribute to the characteristic aroma and flavour of the product. Both volatile acidity and diacetyl and acetoin contents of probiotic yoghurt increased and reached the peak values after 3 days followed by the decline after 7 days of storage (Table-1).

Dietetic Characteristics

Proteloytic activity and β-D-galactosidase activity of probiotic yoghurt increased and reached to their peak values after 3 days. However, a decline in their content was observed after 7 days of storage (Table -1). Increase in proteolytic activcity in the product indicates better digestion and an increase in biological value of proteins. Presence of β-D-galactosidase activity in probiotic yoghurt indicates its suitability for lactose-intolerant infants. No change in lactic acid content of the product even after 7 days of storage was registered. Probiotic yoghurt had *Lactobacilli, Bifidobacteria* and *Propionibacteria* counts in the range of 10^8 cells/ml, required for successful seeding in the intestine, even after 7 days of storage (Table-1). A viable population of 10^8-19^9 cells/ml. of the product is required for successful implantation in the intestine (Tanaka *et al.*, 1982; Kim, 1988).

The product also exhibited desirable antibacterial activity against different test organisms, namely *Salmonella typhimurium, Shigella dysenteriae, Bacillus cereus and escherichia coli* (Table-1). Probiotic yoghurt containing 10^8 cells/g, given to healthy infants, for a period of 7 days after meals, showed a decline in coliforms and an increase in *Bifidobacteria* and *Lactobacilli* counts in their stools. Results indicate adherence and multiplication of *L. delbrueckii* subsp. *bulgaricus* and *B. bifidum* in increase in intestinal track of infants. An increase in *Lactobacilli* counts (Stefanova, 1979) and *Bifidobacteria* count (Terade *et al.*, 1993) in the faeces of infants and adults due to consumption of yoghurt have been reported.

Table 1. Technological and Dietetic Characteristics of Probiotic Yoghurt

Characteristics	Days of storage at 8 ± 1°C		
	0	3	7
Titratable acidity (% lactic acid)	0.612	0.797	0.825
Volatile acidity (ml 0.1 N NaOH/50 g curd)	2.0	2.9	2.5
Diacetyl and acetoin (ppm)	40.0	101.0	43.0
Proteolytic activity (µg tyrosine/ml)	170	230	125
Lactic acid (µg/ml)	225	225	225
β-D-galactosidase activity (µg ONP/ml)	80	120	110
Propionibacteria count X10^8 (cfu/ml)	2.10	2.17	2.26
Lactobacilli count X10^8 (cfu/ml)	1.83	2.05	1.96
Bifidobacteria count X10^8 (cfu/ml)	1.57	1.66	1.63
Antibacterial activity (Diameter of zone of inhibition in mm)			
Salmonella typhimurium	8.5	6.5	6.5
Escherichia coli 03	7.0	7.5	7.5
Bacillus cereus	9.0	9.0	8.0
Shigella dysenteriae	8.0	8.5	6.5

Nutritional Characteristics

Nutritional characteristics evaluated through rat biossay technique revealed higher weight gains, feed efficiency ratio, protein efficiency ratio and net protein ratio in rats receiving probiotic yoghurt than those fed with laboratory stock diet (Table -2). Hargrove and Alford (1978) also registered higher weight gains and feeding efficiency ratio in rats fed with yoghurt. Wong *et al.*, (1983) ascribed the growth stimulating effect of yoghurt due to improved digestion and absorption of amino acids. The protein efficiency ratio of probiotic yoghurt was higher than buffalo milk based commercially available infant formula and for low-lactose infant formula standardized by Bindra (1979) and Paul and Mathur (1993). Better nutritional status of probiotic yoghurt was due to presence of easily assimilable proteins resulting from proteolytic activity of starter cultures. Thus, probiotics yoghurt is nutritionally adequate for feeding infants and children.

Conclusion

A dosage of 100 g of probiotic yoghurt containing 10^8 cells/g. of *Lactobacilli* and *Bifidobacteria*, once in a day after meals for a period of 7 days can be recommended to provide lactic acid, antibiotic factor and live bacteria in addition to better nutrition qualities supported by addition of *P. freudenreichii* subsp. *shermanii*. The combined action of these factors will create favourable conditions for the proliferation of intestinal *Bifidobacteria* and *Lactobacilli* and discourage the growth of harmful organisms in addition to providing improved nutrition. The information obtained from this investigation seems to have high potential for application in production of probiotic yoghurt by the food industries.

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Table 2. Nutritional Characteristics of Probiotics Yoghurt

Nutritional attributes	Types of Feed					
	Laboratory stock feed			Probiotics yoghurt		
	Intervals of analysis (days)					
	10	20	30	10	20	30
Average gain in body weight (g)	20	2	6	31	16	8
Feeding efficiency ratio	0.066	0.008	0.018	0.074	0.024	0.019
Net protein ratio	0.006	0.002	0.002	4.22	1.43	1.36
Protein efficiency ratio	0.004	0.001	0.001	3.16	1.01	0.80

Note : Average initial weights of rats were 45-50 g.

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Infant and Weaning Food Formulations Containing Probiotic Cultures

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Introduction

Breast milk is considered as the most suitable food for newborn infants since time immemorial. It is the natural security provided for the survival of the infants. A progressive decline in the incidence of breast feeding has been observed during the last 25-30 years. (Kneebone, 1976). According to surveys conducted by various agencies like WHO, OPCS, ICMR etc., there is a significant increase in the tendency of bottle feeding and early weaning all over the world. According to WHO study considering 24,000 mother-child pairs in Chile, Ethopia, Guatemala, India, Nigeria, Philippines, Zaire, Sweden and Hungary, breast feeding was noted to be declining among urban elite but was constant and prolonged among the rural poor (Hofvander and Petros-Barvazian, 1978). A multicentric survey was conducted by NIN, Hyderabad in Andhra Pradesh involving 36,000 children. According to the survey, the breast feeding is continued for more than one year in rural areas. However, the mothers tend to discontinue breast feeding after five months and by 12 months and more than 90% of the infants are fully weaned in urban areas (Rao, 1983). Earlier, the right age for weaning was considered to be about 1 year or even more, while now-a-days it is not very uncommon to wean the infants starting from the age of 3-4 months. (Hofvander and Petros-Barvazian, 1978; OPCS, 1985; Rao 1983). In an industrialized nation like UK, a survey indicated that 36% of the mothers gave infant formulae from birth and by six weeks, 61% of infants were exclusively bottle fed (OPCS, 1985). This review has been prepared in order to compile and present information about the developments in infant formulae and weaning foods with special reference to use of probiotic cultures.

Commonly Used Terms

Infants: Newborn babies up to an age 12 months are usually considered as "infants" and above this age, the term 'child" is used.

According to surveys conducted by various agencies like WHO, OPCS, ICMR etc., there is a significant increase in the tendency of bottle feeding and early weaning all over the world.

Weaning: The term "weaning" comes from the word "wenian" which means "to accustom". Definition of weaning includes: "introduction of food other than mother's milk" or "complete discontinuation of breast feeding" or "introduction of solids into the diet". However, the exact tradition varies from country to country.

Generally, the term "weaning" is used to denote the process in which infant changes from breast milk to a mixed diet, starting with small quantities of complementary foods given regularly in increasing amounts, until replacement of breast milk is virtually complete (Push-pamma, 1983).

Infant Formula: In general, infant formula/infant food may be considered as the milk based formulation which is intened to replace human milk which may/may not be made similar in gross composition to human milk and may contain some functional ingredients to provide benefits similar to those obtained from human milk. It may contain certain ingredients from animal and/or plant sources.

Weaning Foods: There is no clear definition of weaning foods but in general, they include all staple foods that are the first foods added to the diet of infants (Macrae *et al.*, 1993).

Historical Aspects

Until early 1900, there was no alternative to breast milk for feeding infants. Consequently, over 80% infants were breast-fed (Pushpamma, 1983). The 1940s marked a major turning point in the history of infant feeding in the UK with an increasing proportion of babies being bottle-fed (McBean, 1992). Initially, people have used cows milk as the alternative for mother's milk. Later on during studies by various researchers, it was found that cow's milk is not suitable for feeding infants up to 12 months of age because of : (i) iron deficiency, (ii) high renal solute load, (iii) nutrient deficiencies, and (iv) cow's milk protein

allergies (Ghosh *et al.*, 1989; McBean 1992). The use of dried milk then came into existence. Considering deficiencies of cow's milk, people started adding vitamins and minerals to dried infant formulas.

However, these formulas were not adapted to meet the specific nutritional and physiological needs of newborn infants. High concentrations of minerals especially sodium, chloride, phosphorus and calcium caused many problems including hypernatraemic dehydration, neonatal tetany and even death in some cases (McAlister and Dixon, 1993; Thompkinson and Mathur, 1989). The detailed knowledge of compositional and functional differences between human milk and bovine milk led to the development of humanized formulas which provide an acceptable alternative to human milk (Macrae *et al.*, 1993). The major modifications in cow/buffalo milk composition for its humanization include: (i) removal of casein, (ii) partial replacement of milk fat with vegetable fat (iii) addition of mucopolysaccharides, (iv) enrichment with lactose, and (v) removal of calcium (Ganguli, 1978). Though these humanized infant formulas are similar in chemical composition to human milk, all the bioactive components present in human milk viz., immunoglobulins, lysozyme, lactoferrin, enzymes etc. could not be incorporated in infant formulas (Mathur, 1993; Pahwa and Mathur, 1987 a,b).

Reasons for Decline in Breast-Feeding

There are several reasons possible for inability of mother to breast feed: (i) medical conditions like galactosaemia and congenital alactasia, (ii) passage of maternal medication into breast milk in pharmacologically significant quantities (iii) problems related with lactation, (iv) disease like AIDS, (v) unavailability of working mother due to busy schedule (vi) considerations of maintaining figure, (vii) lack of education, (vii) industrialization and urbanization, (vii) inconvenience and (ix) social status etc. (Macrae *et al.*, 1993; Mishra, 1982; Stanway, 1978).

Definition of weaning includes: "introduction of food other than mother's milk" or "complete discontinuation of breast feeding" or "introduction of solids into the diet".

Current Infant Feeding and Weaning Practices in India

Presently, in India, breast feeding is found to be prolonged in rural areas, whereas bottle feeding and early weaning is common in urban areas (Hofvander and Petros Barvazian, 1978; Rao, 1983).

Traditionally used weaning foods include soft cooked cereals, pulse *khichrees*, rice gruel (Gujarat), *chapati* soaked in hot unspiced *dal*, *lassi* (North and Central India), soft cooked rice combined with finely chopped and minced vegetables or pieces of meat (North Eastern States), steamed tapioca or rice with flaked fish (Kerala), ragi balls pulped in unspiced *sambhar* (Karnataka), tea, fruit juices, biscuits, smashed fruits etc. (Pushpamma, 1983).

Presently, in India, breast feeding is found to be prolonged in rural areas, whereas bottle feeding and early weaning is common in urban areas.

Feeding of Human Milk and Development of Intestinal Microflora of Infants

A number of research workers have reported that the predominant flora of digestive tract of infants after birth is bifidobacteria which comprise about 99% of the gut microflora (Frisel, 1951; Hayakawa and Mitusuoka, 1982; Laroia and Martin, 1990; Mayer, 1956). The predominant species vary depending on age. Usually in breastfed infants, *Bifidobacterium longum*, *B. infantis*, and *B. breve* are predominant whereas, in bottle-fed infants, *B. adolescentis* is the predominant type, followed by *B. bifidum*. Even in children, adults and aged persons *bifidobacteria* remains as an important component of intestinal microflora. In case of children, *B. infantis*, *B. breve*, *B. bifidum* and *B. longum* are predominant, whereas in adults, *B. adolescentis* and *B. longum* are predominent. They maintain the normal balance of microorganisms in the gut by inhibiting the unwanted putrefactive and pathogenic organisms through production of various organic acids and antimicrobial substances. They also synthesize certain vitamins (especially B_{12}) which promote the growth of infants (Ballongue, 1993).

Human milk is found to contain several chemical compounds that accelerate the growth of *Bifidobacterium bifidum*. These compounds are collectively known as "bifidus factors" which include an oligosaccharide containing N-acetylglcosamine (Gyorgy *et al.*, 1954), lactulose (Petuely, 1957), lactose in presence of certain organic acids (Kokubu, 1961), and certain derivatives of N-acetylglucosamine (Lambert and Zilliken, 1965).

Breast feeding promotes the growth of bifidobacteria in the digestive tract and thus helps in maintaining good health which is not the

case with ordinary or standard infant formulas. Hence, the concept of infant formulas containing viable bifidobacteria and other probiotic cultures came into existence.

Why Cultured Infant Formulas ?

It has been shown that the instential flora of a man weighs between 1 and 2 kg *i.e,* roughly the same weight as vital organs such as liver, brain or lungs. The digestive tract houses about 10^{14} bacteria consisting of approx. 500 species (Ballongue, 1993). New born infants have an almost sterile digestive tract which very soon gets colonized by a number of groups of microorganisms with bifidobacteria as the predominant flora (Salminen and Wright, 1993). It also provides numerous additional benefits like : (i) increased nutritional value, (ii) increased availability of certain vitamins and trace elements, (iii) improved protein metabolism and bowel movement, (iv) reduced problem of lactose intolerance, (v) protection against diseases related to liver, (vi) anticarcinogenic and hypocholesterolemic effects, (vii) prevention and cure of all kinds of gastrointestinal troubles, (viii) activation of immune system and (ix) detoxification/degradation of toxic compounds e.g., enterotoxins, and many others (Nakazawa and Hosono, 1992).

Classification of Cultured Formulations

The cultured infant formulas can be classified by three methods viz., form of the product e.g., liquid, paste or powder, intended end use e.g., normal infants, preterm infants, lactase deficient infants or infants with gastrointestinal disorders, and type of culture used for its preparation (e.g., single cultures, paired cultures or multiple cultures containing products). Since the classification based on type of culture used best describes the categories, it is used in this article to describe different formulations.

Single Culture Based Products

(a) Products containing *Lactobacilus acidophilus* : These include *acidophilus* milk (Rettger and Cheplin, 1922), Cultured *acidophilus* cream (Teply *et. al.*, 1968), *Detskaya* (Brents *et al.*, 1982), *Malyuktka* (Korobkina *et al.*, 1981); Nabukhotnyi *et. al.*, 1983; Semenikhina *et al.*, 1984; Vatikus *et al.*, 1980; Voronkova *et al.*, 1986), *Malysh* (Semenikhina, 1988), *Biolakt* (Chokoeva *et al.*, 1980; Lukovnikova and Pyatkova, 1974), *Pastolakt* (Pyatkova *et al.*, 1984), *Khizh* (Arutyunyan, 1987) and other products (Krasheninin *et. al.*, 1980; Kuznestova *et. al.*, 1982; Meduzov and Anisimova, 1983; Pyatkova *et. al.*, 1981). Two dried products viz., spray dried *acidophilus*-malt preparation and spray dried *acidophilus*-banana powder developed at Dairy Science College, Anand can also be used as weaning foods (Shah *et. al.*, 1986).

Breast feeding promotes the growth of bifidobacteria in the digestive tract and thus helps in maintaining good health which is not the case with ordinary or standard infant formulas.

Yoghurt culture containing products are capable of restoring normal lactic intestinal flora and inhibiting undesirable putrefactive organisms.

(b) Product containing *Bifido-bacteria* : These include *Bifidus* milk (Mishra and Kuila, 1992), Lactana-B and Bifiline (Kurmann *et. al.*, 1992), Humana and Bebe-1 (Kochkova and Spasov, 1979), Eledon and Pelargon (Ballarin, 1971; Grieder, 1960) and other products (Pahwa and Mathur, 1987 a,b,c,). A liquid product containing *Bifidobacterium adolescentis* isolated from gut of newborn infants have been developed at Dairy Science College, Anand (Khedkar, 1991).

(c) Products containing *Lactobacillus casei* : This includes a preparation containing viable cells of *L. casei.* The product is claimed to be effective against acute diarrhoea in children (Isolauri *et al.*, 1991).

Paired Culture Based Products

(a) Products containing *Lb. acidophilus* and *B. bifidum*: This includes Biolakt/Bifilakt (Dorofeichuk et. al., 1983).

(b) Products containing *Lb. acidophilus* and *Propionibacterium fruedeureichii* subsp. *shermanii*: These include Vitalakt (Nabukhotnyi *et al.*, 1985), and one more product (Nabukhotnyi *et al.*, 1983).

(c) Products containing *Lb. bulgaricus* and *Streptococcus. thermophilus* : This includes Bulgarian milk and dried bulgarian milk (Kurmann *et al.*, 1992).

(d) Products containing *Str. thermophilus* and *Lb. helveticus* : This includes a product suitable for feeding infants below 2 months of age and could be used to replace mother's milk (Langhendries *et. al.*, 1995).

(e) Products containing *B. adolescentist* and *Str. Thermophilus* : A cultured milk product containing *B. adolescentist* and *Str. Thermophilus* have been developed at Dairy Science College, Anand which was suitable for feeding infants (Khedkar, 1991).

Multiple/Mixed Culture Based Products

(a) Products containing *Lb. acidophilus, B. bifidum* and *Pediococcus acidilacticii:* This includes Femilact (Kurmann *et. al.,* 1992), and one more product (Dolezalek and Kubat, 1982).

(b) Product containing *Str. thermophilus, Lb. bulgaricus* and *Lactococcus lactis* subsp. *lactis* This includes Biolakton **(Ivanov** *et. al.,* 1971).

(c) Product containing *Str. thermophilus, Leuconostoc* spp. and P. *fruedenreichii* subsp. *shermanii:* This includes Elvit (Cerna, 1984).

(d) Product containing *Lc. Lactis* subsp. *lactis, Leuconostoc* spp. and *Lb. Casei:* This includes Aerin (Mostovaya *et. al.,* 1982).

(e) Product containing *Lc. Lactis* subsp. *lactis, Lb. bulgaricus* and *Lb. acidophilus:* This includes Lactipan (Roggero *et. al.,* 1990).

(f) Product containing kefir culture: This includes Baby kefir (Ivanova *et. al.,* 1980).

Advantages of Cultured Infant Foods

[A] Yoghurt culture containing products: They are capable of restoring normal lactic intestinal flora and inhibiting undesirable putrefactive organisms. (Deodhar, 1984; Metchnikoff, 1908), prevents nosocomal infection (Sarkar and Mishra, 1996), reduces lactose malabsorption (Satto and Castaneda, 1974) and lactose intolerance (Gedrel *et al.,* 1990; Rao *et. al.,* 1985), cures subnormal and hyper acidity, gastritis and ulcer (Oberman, 1985), contains higher calcium and proteins and higher Ca/Na ratio (Demott, 1985), increases levels of amino acids, better weight gains and ability to cure gastrioin-testinal disorders (Stefanova, 1979), useful for feeding lactase deficient infants (Paul and Mathur, 1992).

Lc. Lactis subsp. *lactis* and Leuconostoc spp. containing products increase the nutritional and therapeutic status of the products.

[B] *Lc. Lactis* subsp. *lactis and Leuconostoc* spp. containing products: They increase the nutritional and therapeutic status of the product (Roberts, 1977), cures intestinal dysbacteriosis (Mostavaya *et. al.,* 1982) and useful in treatment of chronic aspecific diarrhoea (Roggero *et. al.,* 1990).

***Lb. acidophilus* and *B. bifidum* containing products normalize intestinal microflora and are useful in the treatment of acute intestinal disorders and chronic diseases of digestive systems.**

[C] Kefir culture containing products : They provide antimicrobial activity against staphylococcal species in addition to other benefits of fermented milks. (Korneva *et. al.,* 1979).

[D] *Lb. acidophilus and B. bifidum* containing products: They normalize intestinal microflora and are useful in the treatment of acute intestinal disorders and chronic diseases of digestive systems. (Ladodo, 1980), reduces serum cholesterol (Harrison and Peat, 1974), increases biological value of proteins (Sarkar and Mishra, 1996), cures sepsis and gastrointestinal disease of *staphylococcal* and *proteus* origin (Kuznestova *et. al.,* 1982), reduces counts of *E. coli, Enterobacter* and *Proteus* in the intestines (Mautone *et al.,* 1982; Sandine *et. al.,* 1972), more than 90% of lactic acid produced is L(+) (Smaczny and Reinartz, 1982), useful for treatment of lactose intolerant infants (Meduzov and Anisimova, 1983), useful in treatment of gastroduodenitis and peptic ulcer (Dorofeichuk *et. al.,* 1983) and diarrhoea (Gonzalez *et. al.,* 1990), inhibits reduction of NO_3 to NO_2 (Dolezalek, 1979) and reduces toxic compounds in faeces (Taisho, 1960).

Conclusions

It is universally accepted that infant and weaning foods containing probiotics, or other beneficial microorganisms, have numerous benefits as compared to their non-cultured counterparts. They are very much helpful in curing most of the gastrointestinal and related disorders and many other diseases. They have very good potential to be an alternative for mother's milk as "infant food". Since very long time, in many parts of the world (Bulgaria, Russia, Germany etc.,) these kinds of products are traditionally used and with suitable modifications in the technology, they can be very well adopted and exploited in India too.

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Macro Nutrient and Micro Mineral Composition of Home Processed Dehydrated Foods

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Introduction

Sun-drying has been a method of food preservation for centuries and has been common in many cultures and civilizations. It is the cheapest and natural source of heat for the removal of moisture from foods. Dried/dehydrated foods are equally as nutritious as other processed foods. Drying as a natural means of food preservation has been used for many foods like cereals, legumes, nuts, oilseeds, fruits and vegetables, fish, meat etc. Food processed and dried not only occupy an important place among the traditional foods of India, but are also served as delicacies in star hotels. In recent years, production of these items is on a cottage or small scale. A number of dried products are also used as food adjuncts like *wadia, papad*. The present investigation was undertaken to determine the macro-nutrient and micro-mineral composition of some selected home processed dehydrated products based on cereals, legumes, vegetable and fruits.

Materials and Methods

Fifteen different products from cereals, legumes, vegetables and fruits were collected from 100 households from the coastal region of Andhra Pradesh. These products were analysed for moisture, proteins, fat, crude fibre, total ash. Macro-and micro-minerals viz., calcium, iron, copper, magnesium, manganese and zinc were also analysed. The macro-nutrients were determined by standard procedures (AOAC, 1984; AOCS, 1973). Carbohydrate content was determined by difference. Calcium and other micro-minerals were analysed by Atomic Absorption Spectrophotometer (Spectra AA 20).

Results and Discussion

The proximate and mineral composition of pulse is based products is given in Table 1. *Wadia* and *papad* prepared with pulses were bound to be good sources of protein, ranging from8.77 to 20.94 g%. Maximum amount of ash (10.46g%), crude fibre (8.75g%), calcium (162.6 mg%), iron (27.36 mg%), magnesium (200.83 mg%) and manganese (4.83 mg%) were observed in blackgram + ashgourd *wadia*. Greengram *papad* and blackgram *wadia* had higher amounts copper and zinc. Somewhat similar results were reported for blackgram *wadia* regarding their proximate composition by Pushpamma and Geervani, (1981) and Vijaya Lakshmi, (1981). Among all the powders prepared with pulses, *sambar* powder showed the highest proteins (19.25 g%), fat (12.78 g%), carbohydrates (50.84 g%), calcium 188.7 mg%) and iron (21.92 mg%). Ash (8.42 g%) and crude fibre (9.78 g%) were more in *chutney* powder along with magnesium (210.8 mg%), copper (1.84 mg%) and zinc (5.78 mg%).

Sun-drying has been a method of food preservation for centuries and has been common in many cultures and civilizations.

All the vegetable products showed significant amounts of proteins (2.15 to 9.56 g%) and fat (0.83 to 10.31 g%) with the highest amount seen in curry leaf powder (Table 2.) Dried amla contained 0.83 g% protein and 0.42 g% fat. The ash and fibre contents of the products ranged from 2.1 to 32.8 per cent and 3.4 to 21.1 per cent, respectively, the highest being in curd chillies. This may be due to drying time. All other minerals like iron, magnesium, copper, manganese and zinc were also high in curd chillies. Calcium was maximum in curry leaf powder (571.3 mg%).

The proximate and mineral composition of the cereal-based products are given in Table 3. The moisture contents in the *wadia* prepared using cereals ranged from 8.92 to 12.18 g per 100 g. Among all the cereal-based products, *Suji wadia* contained high amounts of proteins (4.14 g%), fat (1.04 g%), calcium (150.3 mg%), copper (3.11 mg%) and zinc (3.51 mg%). Higher amounts of ash (5.57%) and crude fibre (1.63 g%) were observed in rice flour + *sago wadia* and *sago wadia* respectively. Also, *sago wadia* contained more amount of iron (22.36 mg%). Magnesium (120.9 mg%) and manganese (3.43 mg%) were found to be

Table 1. Proximate and Mineral Composition of Products Prepared Using Pulses (per 100g)

		Moisture g	Protein g	Fat g	Ash g	Crude fibre g	Carbo-hydrate (by diff) g	Calcium mg	Iron mg	Magne-sium mg	Copper mg	Manga-nese mg	Zinc mg
Blackgram *Wadia*	A	8.61 ±1.01	14.11 ±4.78	0.99 ±0.38	7.39 ±2.15	0.28 ±0.17	68.62 ±18.08	148.5 ±12.9	26.08 ±13.17	189.20 ±50.00	2.29 ±0.41	4.66 ±1.42	5.27 ±1.17
	B	19.52 ±0.03	21.18 ±0.40	0.20 ±0.0005	1.35 ±0.02	1.59 ±0.39	52.54 ±0.07	138.5 ±1.9	3.81 ±0.05	153.30 ±0.70	0.91 ±0.54	1.49 ±0.02	2.78 ±0.05
Blackgram + Ashgourd *Wadia*	A	11.59 ±2.72	8.77 ±3.82	1.96 ±0.91	10.46 ±3.86	8.75 ±3.61	58.47 ±6.65	162.6 ±56.8	27.36 ±10.00	200.83 ±52.28	1.33 ±0.81	4.83 ±1.30	4.25 ±1.13
	B	44.63 ±11.09	18.78 ±1.85	0.95 ±0.20	2.25 ±1.02	1.42 ±0.39	32.00 ±5.40	101.7 ±9.9	2.75 ±0.20	113.13 ±8.07	0.58 ±0.05	3.86 ±0.20	1.73 ±0.11
Greengram *Papad*	A	11.80 ±1.40	20.94 ±8.25	3.12 ±0.65	6.51 ±3.44	0.59 ±0.37	57.04 ±14.69	112.3 ±22.5	20.63 ±11.57	186.71 ±18.54	2.37 ±0.86	4.60 ±0.80	5.22 ±1.41
	B	20.08 ±0.05	23.58 ±1.05	2.87 ±0.33	3.40 ±0.15	1.52 ±0.14	59.21 ±0.01	79.0 ±2.8	3.75 ±0.10	116.23 ±2.77	0.38 ±0.01	0.96 ±0.02	2.70 ±0.10
Chutney Powder	A	8.65 ±1.89	16.21 ±3.32	8.63 ±2.44	8.42 ±1.95	9.78 ±5.85	48.31 ±19.87	168.6 ±18.1	11.20 ±0.50	210.80 ±34.70	1.84 ±0.09	4.86 ±1.88	5.78 ±1.15
	B	11.64 ±1.97	19.53 ±2.45	14.53 ±4.79	2.66 ±0.14	4.56 ±0.95	48.94 ±3.49	140.7 ±59.5	8.53 ±0.10	184.50 ±5.10	0.34 ±0.15	1.16 ±0.61	0.88 ±0.37
Sambar Powder	A	7.04 ±1.67	19.25 ±1.75	12.78 ±2.95	6.02 ±1.93	4.07 ±1.29	50.84 ±19.85	188.7 ±58.7	21.93 ±4.52	148.30 ±37.60	1.66 ±0.18	5.23 ±0.59	4.15 ±0.62
	B	10.33 ±0.13	21.18 ±0.43	5.24 ±0.43	3.38 ±0.68	3.88 ±0.43	56.71 ±0.32	145.5 ±15.2	5.65 ±0.26	142.10 ±1.70	1.18 ±0.03	1.21 ±0.10	2.43 ±0.05
Rasam Powder	A	7.52 ±1.55	19.24 ±1.15	9.62 ±4.60	5.10 ±2.10	8.21 ±5.12	50.31 ±16.86	184.8 ±39.0	18.65 ±2.08	172.70 ±32.00	1.58 ±0.30	5.93 ±0.47	4.08 ±0.68
	B	10.55 ±0.05	20.49 ±0.32	5.49 ±0.71	3.64 ±0.29	5.40 ±0.80	54.60 ±2.27	154.2 ±4.3	5.36 ±0.15	137.70 ±6.30	1.84 ±0.76	1.22 ±0.10	2.36 10.17

Note: A - Values analysed on dry weight basis.

B - Values calculated on fresh weight basis

Values given in the Tables are mean values of 15 samples.

Table 2. Proximate and Mineral Composition of the Products Prepared Using Vegetables and Fruits (per 100 g)

		Moisture g	Protein g	Fat g	Ash g	Crude fibre g	Carbo-hydrate (by diff) g	Calcium mg	Iron mg	Magne-sium mg	Copper mg	Manga-nese mg	Zinc mg
Curry leaf Powder	A	10.85 ±2.93	9.56 ±1.64	10.31 ±5.20	12.74 ±4.54	7.73 ±4.43	48.81 ±22.58	571.3 ±146.1	18.30 ±8.34	175.7 ±55.8	2.00 ±0.30	2.33 ±1.18	5.08 ±0.77
	B	41.78 ±5.95	10.28 ±1.24	8.28 ±2.32	3.52 ±0.08	6.79 ±0.65	32.42 ±1.85	564.5 ±86.8	2.73 ±0.17	73.4 ±1.1	0.40 ±0.01	0.43 ±0.02	0.89 ±0.17
Tamarind leaf powder	A	10.54 ±2.69	3.86 ±0.32	1.68 ±0.74	3.24 ±0.70	8.38 ±4.23	72.30 ±21.00	251.5 ±100.3	20.18 ±9.63	267.0 ±9.6	1.30 ±0.42	5.70 ±1.40	3.66 ±1.15
	B	48.83 ±10.42	7.95 ±2.41	3.90 ±2.00	1.81 ±0.36	3.65 ±2.36	24.09 ±6.81	108.1 ±7.6	1.37 ±0.23	40.1 ±0.9	0.24 ±0.04	0.33 ±0.03	0.48 ±0.10
Curd Chillies	A	7.60 ±0.60	4.01 ±1.38	4.63 ±1.48	32.83 ±10.45	21.10 ±9.80	29.83 ±6.29	314.5 ±29.7	29.70 ±6.35	291.5 ±68.6	2.12 ±0.35	6.25 ±0.91	5.38 ±1.10
	B	79.34 ±0.00	2.19 ±0.00	0.76 ±0.00	0.69 ±0.00	6.80 ±0.00	3.00 ±0.00	29.9 ±0.0	2.96 ±0.00	181.3 ±0.0	0.93 ±0.00	0.91 ±0.00	1.18 ±0.00
Potato chips	A	11.74 ±1.97	2.15 ±0.51	0.83 ±0.24	6.34 ±2.82	3.40 ±2.20	75.54 ±18.29	104.3 ±33.6	9.66 ±2.98	63.6 ±11.9	0.74 ±0.29	2.50 ±0.90	2.40 ±1.30
	B	74.70 ±0.00	1.60 ±0.00	0.10 ±0.00	0.60 ±0.00	0.40 ±0.00	22.60 ±0.00	10.0 ±0.0	0.48 ±0.00	30.0 ±0.0	0.16 ±0.00	0.13 ±0.00	0.53 ±0.00
Dried Amla	A	9.56 ±0.92	0.83 ±0.18	0.42 ±0.23	2.10 ±1.00	5.60 ±2.60	81.49 ±24.37	143.1 ±45.1	15.60 ±1.90	116.5 ±57.7	1.45 ±0.29	4.02 ±0.96	4.21 ±2.91
	B	81.80 ±0.00	0.50 ±0.00	0.10 ±0.00	0.50 ±0.00	3.40 ±0.00	13.70 ±0.00	50.0 ±0.0	1.20 ±0.00.	-	-	-	-

Note: A - Values analysed on dry weight basis.

B - Values calculated on fresh weight basis

Values given in the Tables are mean values of 15 samples.

Table 3. Proximate and Mineral Composition of *Wadia* Prepared Using Cereals (per 100g)

		Moisture g	Protein g	Fat g	Ash g	Crude fibre g	Carbo-hydrate by(diff) g	Calcium mg	Iron mg	Magne-sium mg	Copper mg	Manga-nese mg	Zinc mg
Sago *Wadia*	A	12.18 ±2.35	0.88 ±0.29	0.36 ±0.13	0.84 ±0.39	1.63 ±0.50	80.91 ±13.63	106.8 ±43.5	22.36 ±4.28	57.6 ±5.5	1.16 ±0.47	1.85 ±0.69	2.56 ±0.92
	B	21.44 ±0.32	0.59 ±0.05	0.24 ±0.06	0.32 ±0.09	0.72 ±0.47	76.45 ±0.32	13.5 ±1.8	1.31 ±0.25	33.0 ±5.8	0.09 ±0.02	0.49 ±0.09	0.19 ±0.03
Rice flour *Wadia*	A	8.92 ±0.43	3.52 ±0.65	0.51 ±0.06	5.05 ±3.24	0.16 ±0.13	81.79 ±26.46	102.6 ±26.0	11.96 ±1.97	120.9 ±33.1	1.34 ±0.20	3.43 ±0.83	3.30 ±0.90
	B	22.66 ±0.47	6.45 ±0.85	0.59 ±0.09	0.66 ±0.01	0.89 ±0.04	68.62 ±0.18	15.7 ±0.6	1.17 ±0.05	104.3 ±46.7	0.17 ±0.005	1.57 ±0.16	1.32 ±0.005
Rice flour Sago *Wadia*	A	11.09 ±2.03	2.39 ±1.06	0.39 ±0.14	5.57 ±2.02	0.41 ±0.16	80.15 ±38.06	92.4 ±11.4	18.65 ±3.07	104.0 ±10.7	1.23 ±0.53	1.91 ±0.23	2.97 ±0.43
	B	22.51 ±0.18	4.62 ±0.45	0.49 ±0.04	0.85 ±0.07	1.16 ±0.10	70.73 ±0.61	16.8 ±1.6	1.43 ±0.11	81.4 ±38.4	0.16 ±0.005	0.96 ±0.02	1.30 ±0.54
Suji *Wadia*	A	9.01 ±1.00	4.14 ±1.01	1.04 ±0.65	4.67 ±2.50	1.40 ±0.48	81.74 ±30.18	150.3 ±40.3	17.48 ±4.05	90.5 ±4.1	3.11 ±0.99	3.10 ±1.28	3.51 ±0.50
	B	23.12 ±0.41	9.49 ±0.24	0.81 ±0.07	0.15 ±0.05	0.84 ±0.13	66.13 ±1.47	18.2 ±1.4	1.94 ±0.03	40.2 ±2.9	0.11 ±0.01	0.62 ±0.46	0.20 ±0.01

Note: A - Values analysed on dry weight basis.

B - Values calculated on fresh weight basis

Values given in the Tables are mean values of 15 samples.

high in rice flour *wadia*. *Wadia* prepared with cereals had high carbhohydrate contents, ranging from 80.15 to 81.79 g per 100 g.

Conclusion

Different home processed sun dried products, analysed for their proximate and mineral composition, showed that cereal-based products contained higher per cent of carbohydrates and pulse-based products contained more per cent of proteins, moderate percentages of fat, ash and crude fibre. Vegetable and fruit-based products were good sources of ash and crude fibre. products prepared from pulses, vegetables and fruits were good sources of all the minerals.

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Popcorn - What is it ?

FAUSTO F. DIAS AND DARSHAN C. MEHTA

The Anil Starch Products Ltd., Ahmedabad - 380 025, India.

Introduction

What is popcorn ? The word corn in popcorn refers to maize, that is what the North Americans call maize. While the rest of the world refers to corn as maize, they have adopted the word popcorn. You do not hear of popmaiz !

Dr. Paul C. Mangelsdorf, Professor of Botany, Head of the Botanical Museum of Harvard University believes that " There is no doubt that the original corn-wild corn and easily cultivated corn - was popcorn and it is quite possible that the first use man made of corn was for popping".

When the white man landed in the Americas, he found

- that the natives of the West Indies were selling popcorn decorations. (Arawak and Carib Indians of the Indies and the Mayas and other Indians of Central America and the Yucatan popped corn.)
- Cortes in 1959 got his first glimpse of popcorn when he invaded Mexico. Popcorn was an important food of the Aztecs Indians, who also used it for decorating ceremonial headdresses and to ornament the statues of their gods.
- writing of Peruvian Indians about 1650, the Spaniard Cobo says, " They toast a certain type of corn till it bursts. They call it pisancalla and they use it as the confection".
- Flaix de Azara describes a variant of popcorn, from 18th century Paraguay, with kernels on the tassel which, when "it is boiled in fat or oil, the grains burst without being detached, and there results a superb bouquet fit to adorn a lady's hair at night without anyone knowing what it was. I have often eaten these burst grains and found them very good".
- Early French explorers through the Great Lakes region around 1612 found the Iroquois "plains" Indians popped popcorn soup.

Popped corn rapidly absorbs moisture and becomes tough at a moisture level about 3%.

- The English colonists were introduced to popcorn at the first Thanksgiving Feast at Plymouth, Massachusetts, when Quadequina, brother of the Wampanog chief Massasoit, brought a deerskin bag of popped corn to the celebration as a gift.
- The Indians (American) would also bring popcorn "snacks" to meetings with the English colonists as a token of goodwill during peace negotiations.

It is possible to use spices and seasonings suited to Indian tastes to flavour popcorn meeting Indian wants.

- Colonial housewives quickly put popcorn to practical mealtime uses and served popcorn with sugar and cream for breakfast - the first "puffed" breakfast cereal eaten by the white man.

Popcorn in the USA

Popcorn is available as both the yellow and white varieties. The yellow variety outsells the white variety by a wide margin (33 times in 1996). The sales of popcorn (unpopped) in the United States has been increasing over the years as shown below:

- 1970.....160 thousand MT
- 1980.....258 thousand MT
- 1990.....426 thousand MT
- 1996.....485 thousand MT

In the United States, about 70% of popcorn is eaten at home (home popped and pre-popped). Unpopped corn represented about 90% of the sales to homes. More popcorn is consumed in the United States than any country in the world.

The average yield of popcorn in the U.S.A. was about 3.7 MT per hectare. This is lower than the yield of regular corn (maize) which was about 8 MT per hecate.

What is Popcorn ?

Of the different types of corn, popcorn (*Zeamays everta*) is the only one which pops. There are various types of popping corn, which comes in various colours ranging from white to yellow, to red, to black, with several colours in-between. However, as stated earlier, only the yellow and white varieties are available commercially.

The reason why popcorn pops is due to the water in the kernel. As the kernel is heated, the water in the kernel is super heated, and at the time of popping converts into steam, which provides the driving force for expanding the hermo-plastic endosperm after the kernel ruptures. The pericarp and the outer layers of the kernel participate directly in the popping action by serving as a pressure vessel enclosing the endosperm. Popping occurs at about 177°C, which corresponds to

a pressure of 9kg per square centimetre. Hybrids of varieties with high proportion of translucent, flinty, or vitreous endosperm gives higher expansion rates than corn with floury endosperm. Expansion volume is the most critical value for popcorn. The popped volume is important because the commercial buyer purchases popcorn by weight and sells it by volume. Also, popping volume is positively correlated to organoleptic properties such as tenderness and crispness. Most commercial popcorn gives about 40% expansion on popping.

Popcorn can pop into two basic shapes; snowflake, which pops big and is shaped like a cumulus cloud; and mushroom which pops into a round ball. The latter type is preferred in the confection industry because of superior handling characteristic and the more efficient manner in which it can be coated with syrups and flavours. The snow flake (or butterfly) types are preferred for on-premises popping as these types have a higher expansion and therefore a large volume. Besides, they have a better mouthfeel.

Popcorn is usually popped in oil (wet popping), though in very large operations, popping is done with the use of radiant heat (dry popping) at about 215° C. Dry popping requires 25% less oil than wet popping. Oil is added to the popped corn and is often the vehicle for adding flavours and colours.

Popped corn rapidly absorbs moisture and becomes tough at a moisture level about 3%.

In the early 1980's, microwave popcorn became available. In the U.S.A., where over 80% of homes have microwaves, the sales of this variety have increased over the years. Microwave popcorn permits the consumer to have several variations of the staple product, ranging from low fat to "gourmet". Popcorn kernels are packaged under vacuum in containers designed for microwave heating. The reduced internal pressure that is maintained during popping produces a product with more volume and superior attributes.

The main fibre in popcorn is cellulose and its fibre content has earned it recommendations from the American Dietetic Association, and The National Cancer Institute.

Nutritional Attributes

Unpopped, the popcorn kernel (like that of regular maize) has about 71% carbohydrates (mainly starch), about 10.5% protein, 3% fat, 3% crude fibre (all on dry basis) and 13.5-14.5 water (the optimal level for maximum popping). Because popcorn is a high carbohydrate, low and sugar food, it is ideal for snacking. Between meals, it satisfies the appetite without spoiling it. It is included on the American Dental Association's list of sugar free snacks. The main fibre in popcorn is cellulose and its fibre content has earned it recommendations from the American Dietetic Association, and The National Cancer Institute.

Since number of households, in India, with microwave ovens are increasing, there is scope for microwaveable popcorn as well.

Of interest to the calorie conscious is that popcorn is lower in calories than other snacks; a cup of oil popped popcorn contains 40 calories versus 150 calories to a cup-full of potato chips.

Opportunities for the Food Technologists

In the United States, large quantities of popcorn are sold as formulated snacks. Regular ball popcorn is treated with coatings free of water. Butter or buttery flavoured vegetable oil is generally used as carriers for flavours and colours. It is possible to use spices and seasonings suited to Indian tastes to flavour popcorn meeting Indian wants. Given the availability of suitable popping corn (which should not pose a problem if the farmer is assured of increased earnings), it is only the imagination of the Indian food technologists that would limit the range of products which could become the Indian snackers delight, besides being healthy.

In India, special varieties of rice and millets, as well as seeds of *Amaranthus* have been used for popping. These are eaten as such or formulated into snacks such as *laddus, chikkis* and savoury snacks. Popcorn has gained in popularity in India in recent years and is now available in small towns besides the larger metros. Electrical corn poppers have been recently introduced in the Indian market. What is needed is quality corn for popping packaged in a manner so that it reaches the consumer in a condition ideal for popping. As indicated earlier, there is an optimum moisture level at which popping is best. If not stored in sealed containers, the moisture reduces below the optimum in most Indian climatic conditions. The corn should also not insect infested, and it should be free of extraneous matter. The number of kernels which do not pop (spinsters) should be low. Since number of households, in India, with micrwave ovens are increasing, there is scope for micrwaveable popcorn as well.

Acknowledgement

The authors acknowledge use of information supplied by the Popcorn Institute, Chicago, U.S.A.

NEW MACHINERY

Effluent Treatment

Patel Brothers offers the Cavitation Air Flotation (CAF) system for effluent treatment from Hydrocal, USA. The system is used for treating effluents from paper and oil mills, dairy plants, food and meat processing units, tanneries, textile mills and wool scouring units, municipal waste, etc. The system is said to cut effluent treatment cost by 40-90%.

For more details write to
Patel Brothers Services and Engineering Pvt Ltd.
6, Elphinstone Bldg,
10 Vir Nariman Road,
Fort, Mumbai - 400 001.

Total Organic Carbon Analyser

SGE's Anatoc™ total organic carbon analyser is a simple to use instrument designed for the rapid determination of aggregate organic carbon in water. This instrument utilises patented photocatalytic oxidation technology which provides a simple and safe method for the rapid TOC determination. In the presence of near UV light, titanium dioxide catalyses the oxidation of the most intractable organic compounds to carbondioxide which is then detected using a conductivity probe. The Anatoc provides fast, reliable analysis without the use of hazardous oxidising agents and clumsy, self-contained microprocessor controlled unit which is easy to use and requires minimal operator input. Results are available in minutes instead of days.

For more details write to
SGE Laboratory Accessoris Pvt. Ltd.
209, Milan Industrial Estate,
Abhudaya Nagar,
T. J. Road, Mumbai - 400 033.

Digital Conductivity Meter

The PBS conductivity meter is a fully solid-state instrument used to measure conductivity of DM water, distilled water and any solution. Available for both industrial and laboratory use, conductivity cells (sensors), SS 316 as well as PVC, are designed according to the application. Conductivity ranges from 0-200, 0-2000 to 0-20000 US/cm for cell constant K=0.1, K=1, K=10; display is 3-1/2 digit red LED (0.5" height) and accuracy 2.5% of FSI ± LSD. The same instrument is also available for control purpose. The contact rating is 5A (230 V AC) and contacts 1 No/NC. It works on 230 VAC and has a DIN standard size of 96 mm x 96 mm x 150 mm.

For more details write to
PBS Electronics
10 Dattani, 5 A, Shivaji Road,
Kandivli (West),
Mumbai - 400 067.

Mixers and Process Equipment for R & D

Stephan, Germany, offers a range of mixers and process equipment for research and development work in cosmetics, pharmaceuticals and chemicals as per GMP norms. The mixers and equipment include: Universal Mixer UMC (50-150 litres) and TC (200-850 litres); Microcut Toothed Mill MC (10-140) and MCH (20-90); and Vacutherm Mixer VM/MC (200-4,500 litres). Applications include: size reduction, mixing and emulsification of dry and wet mixtures, very fine dispersion, heat treatment (80°C), sterilisation (125°C) and HT processing (140°C).

For more details write to
Tricon 6, Prachi, 913
Deccan Gymkhana
Pune - 411 004.

Pneumatic Conveying System

Poly Quip offers various range of pneumatic conveying systems from 100 kg/hr and distances ranging from 10 m to 500 m for chemical and process industries for conveying products like pharamaceuticals, dyes, intermediates, minerals, lime powder, plastics, fertilisers, grains, soap noodles, etc. These systems are highly energy efficient for unit weight of material transferred. The company also offers these systems with complete PLC based automation for different operations to suit requirements. These systems can be specifically designed for efficient transfer of materials to multipoints. Electronic batching, automation, etc can also be incorporated to suit specific needs. Special features are introduced into the systems to prevent moisture loss during conveying.

For more details write to
Poly Quip
43/2, Loonet Bldg, 2nd Floor, 191
Dr. Ambedkar Road, Dadar (East),
Mumbai - 400 014.

NEW MACHINERY

Drum Heater

PIC manufactures drum heaters for handling viscous and solidified-materials such as fat, gelatine, glucose, grease and heavy oils, petroleum jelly, phenols, tar, varnish, waxes etc. The drum heater acts as a mobile oven operating at black heat. It made in two sections, hinged at the rear side, which can be slid around the drum to heat whole drum surface. The heated material can be removed by draining, dipping, pouring or pumping. Alternatively, the drum material moves next to the drum wall. The remainder of contents will then drop into a storage or process vessel underneath the drum. The whole surface of the drum is heated uniformly and overheating of the contents is thus avoided. Susmotherm drum heater offers all the advantages inherent in electrical heating, such as cleanliness, ease of control, speedy and simple operation. It is constructed of strong MS outer wall. The inner wall is of strong aluminium with 3" to 5" of glass wool insulation in between. The back part of the heater is hinged to facilitate sliding, of the drum in the heater. The front has two handles one on each half, for easy closing and opening of the heater in position when closed and in operation. Electric connections in two boxes and two castor wheels on each half are provided for easy movements of the heater. Apart from sliding the heater around the drum described, various other methods in exact temperature control are used, and the drum heater can be equipped, at a small extra cost, in exact accordance with user's requirement.

For more details write to
Process Instrumentation & Controls
15-F, Kasturba Nagar, Sama, Post EME, Vadodara, Gujarat 390 008.

Portable Digital Infrared Thermometer

MB Control and Systems has introduced an infrared thermometer (Model TM-908). This microprocessor-based-infrared thermometer provides non-contact temperature measurement. It is ideally suited for measuring temperature. In electrical panels, rotating drums, moving objects, food and beverage and numerous other applications. Range of the instrument is -10 to 300°C (14 to 572°F). Temperature scale can be selected between C or F. Accuracy is ±20% of reading. Emissivity can be adjusted between 0.10 and 0.95. Memory is available in the instrument to store maximum, minimum and average. The portable instrument is lightweight and operates on 9 V DC battery. It is supplied complete with IR sensor and carrying case.

For more details write to
M B Control and Systems Pvt. Ltd.
31/1, Ahiripukur road,
Calcutta 700 019.

Float Switch

Pragati Engineering manufacturers vertical-mounting float switches, useful for sensing liquid level in any tank. The switch is made up of magnetic pick-up reed, and the flute is of nylon. Switches can be available in NO, NC or both NO-NC contact. Contact rating is 1 A at 220 V AC. Square flange, made up of fibre is used to protect any electric leakages. Switches are available from 50 mm to 1.8 m (6ft) height, and are most useful for hydraulic powerpacks, remote tanks, lube units, underground/over-head tank automation, etc. Also offered is fully automatic level controller for any underground/overhead tanks.

For more details write to
Pragati Engineering Works
105 Ashok Service Indl. Estate,
Amrut Nagar,
Opp. Gokul Nagar, LBs Marg
Thane 400 601.

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Watrion has introduced innovatively designed equipment for the treatment of industrial effluent water and sewage. The two-in-one and three-in-one systems require less space and spares, are easy to operate and consume less time. These systems are installed after a clarifier to remove suspended matter, colour, odour, organic matter, part of COD and BOD to make them fit for disposal. A system for complete recycling of waste water with zero waste is also possible with softener and UV systems. The water used for backwashing of filters is allowed to flow through a sludge drying bed and output of these bed will be sent back to the clarifier. The solid waste from the sludge drying beds is disposed of:

For more details write to
Watrion Water & Filter Engg. Pvt. Ltd.
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J.P. Road, Andheri (West),
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Simcon offers hi-tech two-stage electrostatic air filters for submicron air filtration down to 0.2 micron. Typical filtration efficiency

at 0.3 micron is around 92-95%. Models up to 100000 CMH can be offered, and so also fully automatic or semi-automatic washing systems. The filters find applications in high volume air-conditioning systems to clean input air into the control room computer stations and other environmentally controlled areas. Intake airfiltration for process industries as well as for pressurised ventilation can be achieved effectively. Precipitators like cyclones, bag filters as well as air washers are also offered for certain applications.

For more details write to
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Temperature Indicator

Omega Electronics offers a digital temperature indicator in various models to suit any range between 0-1,600°C. Inputs can be thermocouples (J. K,R,S,T), or RTD (Pt 100). The display is 3-1/2 digit LED. Accuracy is ±0.5% fsd+1 digit. The instrument is housed in a metallic enclosure of size DIN standard. The company also offers temperature controllers, digital timers, preset counters and pulse counters.

For more details write to
Omega Electronics
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Malad (West), Mumbai 400 064.

Air-Pollution Control Equipment and Systems

Supreme undertakes complete designing, fabrication and erection of fume extraction systems of industrial plastics life FRP, polypropylene-FRP, PVC, PVC-FRP. These systems play a vital role in modern manufacturing processes. The company also supplies various types of scrubbers, centrifugal blowers, ducting, piping systems, chimney and suction hoods.

For more details write to
Supreme Fibre Glass Inc.
11 Keytuo Industrial Estate,
Kondvita Village Road,
Andheri (East), Mumbai 400 059.

Spray Dryers and Flash Dryer

Karl Fischer Industriesnlargen GmbH, Germany, manufactures spray dryers and flash dryers. The spray dryers are not only suitable for solution, suspensions and emulsions but also for pastes; the product is fed as a liquid and is continuously dried and converted into powder within a few seconds. The flash dryers are used for free-flowing and fine-grained products, which can be pneumatically conveyed for continuous drying. Since the particles get dried in a few seconds, the flash drying process is also suitable for temperature-sensitive substances.

For more details write to
Impetus Incorporated
K-56/4, Anna Nagar, (East)
Chennai 600 102.

Vibratory Screen

Mogensen Raw Materials Handling manufactures a range of vibratory screens. The Mogensen sizer is a screening machine fitted with five mesh decks arranged at increasingly steep slopes from the top to the bottom deck; coarse mesh apertures are up to twice the intended separation size. The system resist "pegging" and blockages generally, but has high specific throughput rates and good screening efficiency. The sizer is offered in many models - 0.5 metre 5-deck models; and 1-metre, 1.45-metre, 2-metre and 3-metre models with six, five or three decks to suit screening requirements. The sizers are used in ore processing, coal screening, quarrying and clay minerals. Also manufactured are single, multi, long-deck and modular screens.

For more details write to
Mogensen Raw Materials Handling Ltd
Harlaxton Road, Grantham,
Lincolnshire, NG31 7SF, UK.

Weight/Volume/ Level Indicators

Modi offers indicators which show tank contents in weight or volume. The Weitex systems include load cells and remote-reading digital indicators with a range from a few hundred kg up to several tons or their equivalent in kilo litres. Desk-top terminals are also available to store a large number of input-output transactions, and to print out a variety of forms, tickets, challans and reports on a fully dedicated dotmatrix printer; the equipment can also interface with a computer. Besides weight indicators for tanks and hoppers, electronic and mechanical weigh-bridges are also offered for trucks, tankers and wagons, belt scales, belt weighers, crane scales, etc and conversion kits for converting local-reading mechanical scales to remote-reading electronic ones.

For more details write to
Weitex-Modi
72 Chikloli MIDC,
Ambernath 421 505.

Blister Packing Machine for Dairy Products and Processed Foods

The Blister Packing Machines, with volumetric filling, from Raghu Marketing, is said to be based on a new concept of packaging, and are particularly suitable for packing butter, cheese, jams/sauces, pickles, chutneys and even liquids in small packings of 10-500 g. The machine forms blister of the required size from thermoformable films and operates at ten strokes per minute. Batch number, date, etc are marketed by a rotary printing device. Time-settable hearts seal the back sheet after the filling. Cutting and slitting are adjustable. The filling unit attached with this machine is available in various configurations. Except the loading of the processed product into the hopper, all operations are automatic. Food-grade stainless steel is used for the filler and the moving space for the transportation of the processed food. The total operation is controlled with PLC. The changeover and cleaning time for the filler is as little as 5 minutes.

For more details write to
Raghu Marketing
RZ-16-B-3, Galla No. 1,
Palam Road, Sagarpur,
New Delhi 110 046.

Eccentric Screw Pumps

SEL Pumps Series are specially designed for the problems of pumping highly viscous substances, enables users to handle many materials never before regarded as pumpable. These pumps are more efficient and hence consume lesser power than conventional pumps used in its range in sugar industry. SFL pumps are operated with comparatively lesser down time and maintenance costs, with leakage - proof operation. It saves recurring cost of power. SEL range of pumps for sugar industry are : mixed sugar juice, syrup, sugar melt, magama, massecuite, molasses of all grades and filter cake. Applications are in sugar mills, sugar down stream products, Cogeneration Plants; bagasse and molasses plant; gur, Khandsari manufacturers; sugar based end products; Candy and confectionery manfacturers; distillery and Brewery; Pharmaceutical and cosmetic; Boiler feed water plants; Fuel oil for boilers; and Chemical dosing for boiler and process plan.

For more details write to:
Saraswati Engineering Ltd
Pump Engineering Division
D-12, Site-1, Panki Industrial
Estate, Kanpur 208 022.

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VR Filter Systems manufactures a range of filters for compressed air, lube oil, hydraulic oil and water circulating systems. Filter housing, filter cartridges and filter elements for all these applications are manufactured. Filters and filter housings and elements can also be manufactured to specific designs and shapes apart from the standard ranges. Filter elements used are of wire mesh, polypropylene, fibre paper and other papers according to applications and requirements. Filters are manufactured to capacity of up to 1000 LPM/1000 CFM flow, pressure up to 250 bar, and filtration up to 5 microns in oil filters and 1 micron in air filters.

For more details write to
VR Filter Systems
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Coimbatore 641 035.

Centrifuge For Cutting Oil Filtration

Das Associates has developed centrifuge for filtration of abrasive and metallic particles from cutting oils. Available in automatic and semi-automatic modes, the units can handle straight cutting oils or water-soluble coolants used in grinding, honing and other superfinishing work. An exclusive feature of the system is the automatic scraping of the dust accumulated on the inside walls of the centrifuge drum and its collection in the trolley at the bottom. The units come in three sizes - 30 LPM, 75 LPM and 150 LPM. The advantages of the system include; suitable on straight cutting oil where conventional systems are not effective due to the filter paper getting choked; can handle both magnetic and non-magnetic impurities; filtration up to 20 microns right from the start; and does away with the need to replace the filter paper and the recurring cost.

For more details write to
Das Associates
20 New Modella Indl. Estate,
Padwainagar, Wagle Estate
Thane 400 604.

Form, Fill and Seal Machines

Automatic Devices offers form, fill and seal machines (FFS) to pack solids. The machine, CP 1000, uses sophisticated packaging material like heat sealable laminates,

polycoated paper, etc to enhance product life. It is possible to pack goods in various sizes and weights according to the requirements of the consumer to enable greater convenience in carriage, usage, distribution and disposal of the product. The CD 1000 caters to a wide range of manufacturers - manufacturers of milk products, foodstuffs, detergents, spices, pesticides, pharmaceuticals, etc. The machine is fully automatic and electronically controlled.

For more details write to
Automatic Devices
105-A, Hind Saurashtra
Indl Estate,
Andheri-Kurla Road, Marol
Mumbai 400 059.

Double Cone Vaccum Drier With Lump Breakers

Dalco has introduced a double conevacuum drier with lump breakers The drying unit, equipped with lump breakers initially breaks large lumps and subsequently powders them. The rotary action of the drier, together with mechanical action of the breakers, cuts down drying time and gives lump-free product. It effectively removes solvents from centrifuged or filter pressed cakes/ powders fed into the system. Drying of products takes place under high vacuum and low temperatures in totally closed environment. The unit offers many advantages like saving drying time; eliminating needs for subsequent drying operation; handling and exposure of final product is avoided. It gives uniformally sized dry product; smooth internal surface allows easy discharge of product with minimum deposits of processed material; drying is achieved without any release of dust and fumes; ensure purity of product as the internal surface is easy to clean; can process crystalline or amorphous powder which are prone to form lumps. It is available in capacities ranging from 800 litres to 6,000 litres. It is ideal for drying of products where lump formation is a common problem especially for pharmaceutical and chemical products.

For more details write to
Dalco Engineering Pvt. Ltd.
H A Ltd Compound, Pimpri,
Pune 411 018.

Silicone Tubing For Food, Pharmaceutical and Medical Applications

Shandilya Chemicals Pvt. Ltd., offers transparent silicone tubing for food, pharmaceutical and medical applications. Manufactured from FDA approved raw material in clean environment, the tubings are tested for biological reactivity *in vivo* as per USP XXIII-88, Non-toxic; non- leaching and pyrogen free, the tubings withstand repeated sterilisation and are compatible with common drug formulations. These are biologically neutral. The technical specifications are: Appear transparent to transluscent, Shore 'A' hardness 60, Density 1.2, Service Temperature from - 55°C to + 200°C (up to 250°C for shorter period), Elongation at break 500%, and tensile liquids. To use with injection filling machine, ampoule and vial washing machines, vacuum and pressure filtration equipment, peristaltic pump, etc: All medical applications other than permanent implanation; Run off and decanting tubes; Suction & drain tubes; For sprays, breast relievers, atomisers, humidifiers, dialisers; With food & dairy equipment: As gasket for autoclave & ovens; Animal husbandry & infertility clinic for embryo transfer; As insulator in electronic and electrical equipment; and bio-technology, agricultural and research laboratories.

For more details write to
Shandilya Chemicals Pvt. Ltd
Purshottam Bhuvan, 1/3,
Isssaji Street, Vadgadi,
Mumbai 400 003.

Automatic Liquid Dispenser

GEW's Automatic Liquid Dispenser can apply all types of industrial materials in micro dots to any volume. It is particularly suitable for micro dot deposits, lines, potting, or circular dispensing. Precise control of air pressure, time and the size of trips and nozzles ensure consistent deposits, speeding up output, offering high quality and reducing waste by 50%. The equipment can be interfaced with other automatic equipment and fully automated production line. It can be conveniently used for dispensing RTV compound, silicones, anaerobics/butyl sealant, etc, directly from manufacturers' cartridge. Fields of application include consumer products, electronics, instrumentation, jewellery and watches, medical equipment, potting and encapsulation, surface mount, automobiles, etc. It can also be modified to customer requirements.

For more details write to
Grindwell Engineering Works
Mutaiya Estate, Near
Hotel Leela Penta
Marol Naka, andheri-Kurla Road,
Mumbai 400 059.

NEW MACHINERY

Liquid-Filling Machine

Autopack manufacturers a flame proof semi automatic pneumatic liquid filling machine to fill free flowing liquids. Liquids having viscosity up to 250 centipoise can be filled. Special features are table-top model; infinite variable quantity of fill through handwheel with scale read-out; clean cut-off system for drip-free fill; stainless steel cylinder; output variable up to 20 fill/minute; no electric power required; operator and environment-friendly; machine with single/double filling head available; and capacity up to 1,500 ml/stroke in single/double head possible.

For more details write to
Autopack Machine Pvt. Ltd.
C-101, Poonam Chambers,
Dr. A. B. Toad
Worli, Mumbai 400 018.

Automatic Oil Vending Machine

Flowmatics offers automatic oil vending machines for use mainly by edible oil manufacturers for selling loose oil directly to customers. The machine ensures cleanliness of the oil along with accuracy. Machines with one and four outlet nozzles (for different oils) are available with capacities of 100-5,000 ml, respectively (resolution 5 ml). The machine can also be used for filling bottles accurately. Features include; simple and user-friendly; microprocessor-based controller; password facility for keyboard setting; display for weight, batch and cumulative; program retention by NVRAM; fast ADV and digital filtering technique; and automatic tarring.

For more details write to
IPA Flowmatics (P) Ltd
Nagasandra Post, Hessargatta Road
Bangalore 560 073.

Horizontal Plate Freezer

Industrial Refrigeration offers horizontal plate freezers, from J&E Hall ltd, UK, for freezing and preserving small products, Easy to operate, the freezer can be loaded from both sides, sliding freezing trays or freezing frames carrying the products between freezing plates. The products are frozen rapidly because the temperature applied to the fruits or vegetables is very close to the refrigerant temperature. The freezer can accommodate between 3 and 20 stations, capacities ranging from 90 to 1,500 kg per hour, depending on the product. The freezer has a robust all-steel heavyduty frame, hot dip galvanised for maximum protection. The freezing plates are in aluminium alloy for good heat transfer.

For more details write to
Industrial Refrigeration
9th Floor,
Maker Chamber V
Nariman Point,
Mumbai 400 021.

Cleaning and Drying Machine for Industrial Components

Specialities Systems has introduced a cleaning machine for industrial components. Big components are cleaned by high-pressure spray jets. For smaller components, a machine based on air power washing has been developed. These machines can have single or multi-stage cleaning cycles, with fully automatic control. The machines can have automatic handling arrangements. Dryers can be integrated.

For more details write to
Specialities Systems
D-6, New Chandra,
Shah Industrial Area
Veera Desai Road Extn,
Andheri (West)
Mumbai 400 053.

Cone Screw Mixer

The Cone Screw Mixer from **Fabdecon** basically consists of a vertical conical vessel housing a screw parallel to the wall and performing a planetary motion. The planetary motion of the screw is achieved by a highly engineered drive mechanism. The combination of the conical vessel and the planetary screw imparts, to the product being processed, given a three-dimensional motion. The mixing screw conveys the product from the bottom of the vessel to the product surface; the orbital arm orbits the mixing screw along the vessel wall, causing convective mixing of particles; and the speed of particles in the downward direction due to gravity increases as the vessel diameter decreases. The result of these simultaneous actions is a fast and intensive mixing with low power consumption to give high standards of mixing accuracy. The mixer has varied applications; with additional features, it can also be used as an effective dryer. Some of the applications are: mixing and homogenisation of powders, pastes and slurries; vacuum drying of pastes and slurries; addition or injection of liquids to or in dry solids; granulation or agglomeration of powders by the addition of a binder liquid; reaction under vacuum or pressure conditions; crystallisation; inerti-sation; aeration or de-aeration; densifying;

storage and discharge of product with difficult flow properties; homogenisation of colours and particles sizes; cooling; and heating.

For more details write to
Fabdecon Engineers
138 Damji Shamji Indl. Complex,
Off Mahakali Caves Road
Andheri (East), Mumbai 400 093.

Verticle Centrifuge with Bag-lifting Facility

United Engineering Designs, manufactures and supplies vertical centrifuges with bag lifting type arrangements for chemical, dyestuff,, pharmaceutical and textile industries. Special features include full diameter top lid closed and locked quickly swing bolts. The lid weight for the lid is done by hydro-mechanical spring cylinder device so that the lid opening and closing is achived without much effort. Bag lifting ring is positively and instantly locked on to the basket from a single point by a special circlip device. Three-point pendulum has suspended spherical bearings at the top and bottom ends of suspension rods. The centrifuge has the capacity to withstand an off-balance load equal to 4.5% of the rated charge. United Engineering also manufactures vertical top discharge centrifuges, vertical bottom discharge (with scraper and without scraper) centrifuges.

For more details write to
United Engineering Enterprises
No. 15, Pragati Industrial Estate,
N M Joshi Marg Lower Parel,
Mumbai 400 011.

Waste Disposal System

WD Industries, Chennai has introduced a garbage disposal system— **Garbodrain.** A simple machine to operate, it is fitted on to the sink. The tap is turned on, a switch flicked and when all the food waste is dumped in to the sink the Garbodrain pulps it into a fluid state and washes it down the drain, instantly transforming the kitchen into a hygiene zone. Vegetable peels, small bones, egg shells, leftover food are only some of the garbage that can be drained down one's sink with the Garbodrain. The product keeps kitchens clean from putrefield filth, foul odours, flies, cockroaches and rodents and also prevents food from accumulating in the pipeline and thereby clogging it. Approved by the Sewage Board of Tamil Nadu, Garbodrain is marketed by GTEX Holdings, Bangalore and is available in two models, one for domestic applications and the other for hotels, marriage halls etc.

For more details write to
GTEX Holdings Private Ltd.,
No. 9, Kudlu Village,
Kudlu Main Road,
12th K.M. Madivala Post,
Bangalore-560 068.
E-mail: gtexind@ bir.vsnl.net.in.

Weighing Scale for Seafood

The Bangalore based **Essae-Teraoka** has announced the launch of the Essae DS-450-SS weighing scale in technical collaboration with Teraoka Seiko of Japan. It is ideal for weighing wet products like seafood and in other applications like food processing industries and areas where hygiene is of paramount importance. The machine is splash proof and can be maintained and kept clean easily. It has a check weighing facility with a visual indication and can also be interfaced with a PC and printer. Available in 6 Kgs and 15 Kgs capacity, it has a high accuracy of 1/15,000 resolution and a fully stainless steel body.

For more details write to
Eassae-Teraoka Limited
No.377/22, 6th Cross,
Wilson Garden,
Bangalore - 560 027.

Multipurpose Packing Machine

Vinovim from Vinayk Industries of Chennai is a complete packing machine which can pack any free flowing liquids, viscous liquids, powders and granules. The company claims that the machine provides greater reliability and more features at lower cost. The machine is simple to operate and easy to maintain. Its packing capacity can be changed quickly and easily. It has a production capacity of 4200 packets an hour and has low power consumption. It does not necessitate water cooling and occupies less floor space due to its compact design with built-in accessories.

For more details write to:
Vinayak Industries
17, Kattabomman Street,
Ambal Nagar, Ekkattuthangal,
Chennai- 600 097.

NEW MACHINERY

Microprocesser-based Biosensor for L-Lactose

Under its Biolsensor Development Programme, the Central Food Technological Research Institute (CFTRI), Mysore, has developed a microprocessor based L-lactate biosensor and the know how is ready for commercilisation.

Biosensors are modern analytical device that function using a biologically active material, say an enzyme or a protein, in close contact with a detector, an electronic or electrochemical device, that translates the activity of the biological molecule into measurable electric impulses.

These score over other conventional analytical methods such as gas chromatography or high pressure liquid chromatography in that they are accurate, specific, easy to use, rapid, more reliable and often do not require sample pre-treatment.

Biosensors have been used in various fields such as clinical diagnosis of specific diseases, pharmaceuticals, environmental pollution monitoring, agriculture, defence, forensics and food processing.

The lactate biosensor developed at CFTRI uses lactate monooxygenase (LMO) enzyme and is superior to the currently available biosensors which use either lactate oxidase (LO) lactate dehydrogenase (LDH) enzymes.

LO and LDH based biosensor devices have several disadvantages in terms of stability and electrode fouling which may cause rapid inactivation of the enzyme membrances.

The CFTRI biosensor has none of these disadvantages and specifically suits the requirements of food and fermentation industries. It can be calibrated daily and has a life of about 2 months at room temperature before the membrane needs any change.

It can measure 50-800 mg/100 ml of L-lactate in a matter of three minutes.

The biosensor is simple to operate and can also be used for monitoring spoilage in fruit products, taking L-lactic acid as an index of spoilage. Using the device, several samples of mango pulp have been successfully monitored for spoilage.

Biosensors for detecting glucose, sucrose and organophosphate residues in food samples are in the advanced stage of development at the Institute.

Microwave Ovens

Daewoo Anchor Electronics has extended its range of high technology domestic appliances in India with the launch of three new microwave oven models across major cities in the country. The new models are available in capacities of 20 and 26 litres and are aimed at a wide spectrum of consumers from basic users to connoisseurs of cooking. The ovens have advanced technological features such as auto cooking, cyclic defrost system, child lock, a new ventilation system and stainless steel cavity. The ovens are priced between Rs. 9,900 and Rs. 19,990.

Fruit Juicer and Food Processor

The Anjali fruit juicer from Mahavir Brothers, Mumbai is ideal for beating the summer heat. It enables one to make fresh fruit juices and its unique feature is that one can extract seedless juice from difficult fruits like pomegranates and watermelons. This non-electric product is made of ABS plastic and comes with a vacuum base for a firm grip. Maximum retail price is Rs. 368 (inclusive of all taxes).

The Anjali food processor is an ideal all-round kitchen companion for housewives. This non-electric product comes with a variety of stainless steel blades for chopping, slicing, mincing, shreddling, grating, churning, mixing, blending, juice making, coconut scrapping and ice crushing with ease and efficiency. Maximum retail price is Rs. 598 (inclusive of all taxes). A higher capacity model. Aristo, is priced at Rs. 695. The products are available with kitchenware retailers all over the country.

Coconut De-husking Tool

Sri Hari Marketing of Bangalore has come out with a coconut dehusking device which is most suitable as a domestic tool, particularly for women and children and is claimed to be 100 per cent reliable in husking all types of coconuts — fresh or dry, small or big. it is simple to use and is a boon for all coconut tree owners especially ladies and aged persons who find it difficult and risky to de-husk a coconut with conventional tools like choppers, axe, sharp crowbar and the like.

The time taken to de-husk a coconut with this product varies between 8 and 20 seconds. The tool is available in two models — Economy, costing Rs. 155 and Heavy Duty Rs. 250.

For more details write to:
Sri Hari Marketing,
No. 34, 12th 'D' Main,
6th Block, Rajajinagar,
Bangalore - 560010.
Phone ; 3387105; 3403368.

NEW PRODUCTS

Mushroom Biscuits

The Hyderabad based **Suji Foods India,** engaged in processing and marketing of wet and dry mushrooms and their by products, has launched mushroom biscuits, which it claims is the first of its kind in the country. It has come out with five kinds of Suji biscuits — Mush Super, Mush Marie, Mush-choco-Malt, Mush Munchi Masala and Mush Kracker. Mush Marie is promoted as a balanced diet for diabeics with medicinal value — especially for those suffering from insulin related problems. Mush Munchi Masala has a mixture of garlic, ginger, salt and chilli, in addition to mushrooms. Mush-Choco-Malt is positioned as a food supplement for children and the aged.

Enquiries may be made to : Suji Foods India Limited, 5th floor, Triveni Complex, Palace Heights Building, Abids, Hyderabad - 560 001. Phone: 230301, 243907, 231463, Fax : 091-40-230301.

CCMB Takes Protein Tech to US

The Hyderabad-based Centre for Cellular and Molecular Biology (CCMB), country's leading institution of biological sciences has succeeded in commercialising abroad a technology developed by it to produce protein by genetic engineering.

The institute was discussing the modalities with US-based company for commercial exploitation of the technology and an agreement was expected to be signed shortly.

The quantum monetary benefit the centre would get by transferring the technology to the US company may run into six figures.

Scientists headed by Dr. Gowrishankar at CCMB have succeeded in inducing production of protein from a target gene by using common salt as the inducer.

Designated by UNESCO as one of the south centres of excellence in the third world academy of sciences, CCMB has now emerged an international laboratory attracting post-doctoral and visiting scientists from the US, UK, Japan, China and the Czech Republic.

Bacardi Rum to Hit Indian Market

Bacardi Martini India Ltd., a joint venture between Bacardi Martini and Gemini Distilleries, is poised to introduce Bacardi rum, the number one selling drink in the world in the Indian market.

The family of Bacardi rums is currently manufactured at eight distilleries across the world- Bahamas, Brazil, Canada, Mexico, Panama, Puerto Rico, Spain and Trinidad. Bacardi's plant in Nanjangud, Karnataka, will be the ninth in the list.

Sales of Bacardi grew by 5.5 per cent in 1996 as nearly 20 million nine litres were sold worldwide making it the world's largest selling international spirits brand. Apart from Bacardi, other major brands in Bacardi Martini's portfolio include Benedictine Liqueur, Real Tequila, William Lawson's Finest Blend Scotch Whisky and Cognac Otard.

Haywards 5000 is No.2 Beer Brand in India

Shaw Wallace & Co. Ltd. revealed that Haywards 5000 has emerged as not only the countrys largest selling strong beer but also as the second largest selling beer brand overall in India. Kingfisher from the UB group is the number one.

Haywards 5000, according to the company, has recorded a 380 per cent growth over the last three years and sold more than 4.3 million cases last year.

This year, the company has projected sales of six million cases for the brand.

Mr. Philip A.B. Sargunar, senior vice president, Shaw Wallace, said "Haywards 5000 is the only Indian brand to be manufactured from ten breweries spread across the country," adding that a clear movement is visible from whisky to strong beer.

The company has launched Haywards 5000 with top gold foiling and a foiled stamped label.

With the market getting cluttered with foreign brands, Shaw Wallace felt the need to invest in product innovation and quality packaging.

The strong beer segment is growing at three times the rate of growth witnessed by the beer industry as a whole. The segment showed a three-year compound growth rate of 16.5 per cent against 5.5 per cent for the industry.

RESEARCH ROUND-UP

Indigenous Method to Store Fruit Juice for Six Months

A new method for long-term storage of concentrated mango and guava juice without loss of aroma or taste has been developed by researchers of Mysore-based Defence Food Research Laboratory (DFRL). The scientists, who have published their findings in the *Journal of Scientific and Industrial Research*, claim that pasteurized and concentrated juice in polypropylene pouches can be kept for six months.

The scientists have exploited a process called reverse osmosis to remove water selectively from the juice using a special membrane. Since heat is not applied for water separation, energy requirement of the process is bare minimum and thermal damage to colour and flavour is minimized.

The concentrated juice can be used to make ready-to-serve beverages, nectar and squash. Also partially concentrated juice can be utilised for making shelf-stable consumer products with taste and other qualities similar to the fresh fruit juice. The juice can be kept germ-free by aseptic packaging and can be processed further by thermal evaporation followed by spray drying or freeze drying technique to improve the juice quality.

The process, developed by D. K. Dasgupta and K.S. Jayaraman of DFRL, who have carried out earlier work on pineapple, tomato and orange juice, utiises a membrane separation technique like reverse osmosis where water has been forced to pass through a membrane but not juice particles. The pressure difference between two sides of the membrane helps maintain the water flow.

Early Maturing Maize

An early-maturing maize hybrid that can be bred quickly has been developed by the Indian Agricultural Research Institute (IARI), New Delhi. Compared to the existing hybrids that mature in 100-120 days, the new variety matures in just 70-80 days. In this context, it may be noted that compared to the world average maize productivity of 3.83 tonnes per hectare, the productivity in India is only 1.7 tonnes per hecatre.

Superfast Rice

The Institute of Environment Science of the Science and Technology Ministry has grown the superfast rice at its "closed-environment experimental" facility in Aomori prefecture, northern Japan. The rice growing experiment is part of a programme to develop technology for joint international activities on the surface of moon where manned colonies are to be built. The idea is to grow food for the 'inhabitants' of those bases on the moon. Government backed Japanese Agriculture Scientists have developed a rice that can be harvested in a shorter period. Japanese farmers may be the first to colonise the moon and grow a superfast breed of rice there for their food self sufficiency.

Shark, A New Weapon Against Cancer

The Munich journal " Fortschritte Der Medizin" (Progress in Medicine) reported that squalamine, the substance in question, had literally eaten away tumours in US laboratory animals. Now, it is to be tested for the first time on humans.

Squalamine was discovered by US Medical researchers in search of new types of antibiotics. They found that sharks use squalamine as a primitive immune system, which kills off micro-organisms by preventing their cells from dividing.

The substance was found to have an identical effect on blood vessel cells, where it blocks cell control mechanisms, causing the cells to stagnate, so that they can no longer divide.

Without the additional blood supply stimulated by energy-hungry tumour cells, the tumour cells soon starve.

This, says the report, means that squalamine could prevent malignant cells which remain after treatment of the primary tumour from developing into secondary growths or metastases.

DATA BANK

INDIA'S EXPORT OF BASMATI RICE FROM KANDLA PORT (Jan - Oct 1998)

Quantity: Metric Tonnes

COUNTRY	JAN.	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	TOTAL	% SHARE
S.ARABIA	44355	43948	53132	58498	47975	6177	20619	51899	33592	17680	377875	88.889
KUWAIT	7567	701	2466	4578	4207	42	447	5488	3397	4328	33221	7.815
U.A.E.	890	646	970	705	597	314	214	753	1639	530	7258	1.707
UK	149	1183	126	426	168	0	0	211	43	0	2306	0.542
BAHRAIN	447	85	233	106	129	43	128	21	107	21	1320	0.311
USA	34	61	163	0	63	0	64	0	42	42	469	0.110
QATAR	126	0	64	21	21	0	42	64	87	18	443	0.104
OMAN	105	0	21	21	63	0	45	21	0	21	297	0.700
S.AFRICA	0	0	0	0	189	20	0	0	0	0	209	0.490
NETHERLANDS	63	0	0	42	0	21	0	0	0	63	189	0.440
SINGAPORE	21	0	21	0	21	0	0	20	40	0	123	0.290
JORDAN	21	0	22	0	0	0	42	0	0	0	85	0.200
NORWAY	21	0	21	0	21	0	0	21	0	0	84	0.200
ITALY	0	0	42	0	0	0	0	0	0	42	84	0.200
NEWZEALAND	0	21	21	0	20	0	0	0	0	20	82	0.190
RUSSIA	43	0	21	0	0	0	0	0	0	0	64	0.150
RE-UNION IS.	0	0	0	0	0	0	0	43	21	0	64	0.150
CYPRUS	21	0	0	21	0	0	0	0	0	0	42	0.100
LEBANON	21	0	19	0	0	0	0	0	0	0	40	0.900
UKRAINE	0	21	0	0	0	0	0	0	0	0	21	0.500
JAPAN	0	0	0	21	0	0	0	0	0	0	21	0.500
GERMANY	0	0	0	0	21	0	0	0	0	0	21	0.500
AUSTRALIA	0	0	0	0	0	0	0	20	0	0	20	0.500
OTHERS	21	64	42	21	127	0	20	143	210	121	769	0.181
TOTAL	**53905**	**46730**	**57384**	**64460**	**53622**	**6617**	**21621**	**58704**	**39178**	**22886**	**425107**	**100.000**

Source: Kandla Port Trust

To be continued ...

TRADE FAIRS & GET-TOGETHERS

TechnoPharm 99

The first TechnoPharm international exhibition, the main exhibition forum for production supplies for the European pharmaceutical industry and its closely related segments such as cosmetics, personal hygiene and health foods, takes place in the Exhibition Centre Nuremberg from 5 - 7 October 1999.

TechnoPharm is a pure trade fair with product segments for pharmaceutical source materials, process technology including clean room and sterile equipment, quality assurance, special packages and packaging machinery, laboratory and analytical equipment, and related services.

TechnoPharm is backed up by two partners of proven professional competence: First, the APV Arbeitsgemeinschaft fur pharmazeutische Verfahrenstenchnik e.V., Mainz. With 2,400 individual members in 30 countries, the APV ranks as one of the most renowned pharmaceutical institutions in the world. Second, Numberg Messe, as organizer of around 30 highly specialized international trade fairs, one of the most successful and strongly organised European exhibition companies.

TechnoPharm 99 in Internet

Information about TechnoPharm 99 is available in Internet under domain http://www.technopharm.de.

Information about NumbergMesse and the Numberg exhibition venue can be found under domain **http://www.nuernbergmesse.de.**

The TechnoPharm project team of Johann Fuchsgruber (Phone +49(0)911/8606-160), Claudia Hauser (Phone +49(0)911/8606-280) and Britta Bayer (Phone +49(0)911/8606-161).

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Sponsor

APV
Arbeitsegemeinschaft fur
pharmazeutische
Verfahrenstenchnik e.V.
Kufurstenstraβe 59
D-551 18 Mainz.

Cold Chain

The business for the next millennium: 2 day National Seminar on Cold Chain for the Food Floriculture sector on 29th and 30th January 1999 along with COOL '99- an exposition on all aspects related to Cold Chain at Taj West End, Bangalore.

The subject of Cold Chain has been a matter of discussion during the last couple of years. Though the momentum of implementing of cold chain has started in a small way, the pace of its growth is not meeting the needs. The Cold Chain would benefit every one in the food supply chain. i.e., processing industry, business community, exporters, farmers and consumers. This is also of national interest as it helps in reducing the enormous waste occurring now. In order to speed up the growth of cold chain facilities it is necessary to make the people associated appreciate the enormous potential, technical aspects, management issues and investment required. in order to facilitate this, the Centre for Processed Foods (CPF) is organising the above seminar at Bangalore.

The technical sessions in the seminar would include present status and future of Cold Chain, Cold Chain Technologies: Present and future, Cold Chain requirement for fruits and vegetables, dairy, seafoods, meat and poultry and other food products and floriculture; machinery, materials and services for Cold Chain, packaging requirements, refrigerated foods, financing and policy issues. The topics will be presented by top level experts in the field from industry, government, financial institutions, R & D institutions, professionals etc.,

Cool '99

Is a technology exposition on all aspects related to Cold Chain to be held on 28th and 29th January 1999. The exhibit profile include: Refrigeration and air conditioning machinery, insulation, piping, accessories, automation required, cold storage installation contractors, refrigerated trucks and vans, packaging machinery and materials, exporters, airlines and C & F agents, financial institutions, consultants and other organisations. Entrance to the Exposition is free.

TRADE FAIRS & GET-TOGETHERS

Rennaissance in Food Processing Industry in the Next Millenneum on 28th January 1999

If food succeeds, India succeeds. This is because of India being a dominantly agrarian economy and the strengths it possesses. The CPF believes and looks forward to a strong and vibrant India in the coming millennium in the area of Food Processing. Though the food processing industry has been in the limellght for almost a decade now, it has not progressed as expected. One of the main reasons for this could be the lack of coordinated and integrated approach, which is very essential for healthy growth of a sector such as food processing. Even in the above scenario, there are individuals who have made a difference and contributed to the development of certain sectors of the food processing industry. CPF is organising a one-day programme. This event includes felicitating Business leaders of the 21st century in Food Industry and presentation from these leaders on food processing, dairy sector, R & D backward linkage; seafoods, biscuit and confectionery, retailing, spices, packaging, poultry, marketing and food safety.

Business leaders includes:

Dr. V. Kurien, Chairman, NDDB, Mr. R. Gopalakrishnan, Executive Director, Tata Sons Ltd, Dr. V. Prakash, Director, CFTRI, Mr. P.M. Sinha, President, Pepsi Foods Ltd, Mr. Abraham John Tharakan, Managing Director, Amalgam Foods Ltd; Mr. Sunil Alagh, Managing Director, Britannia Industries Ltd, Mr. Chenniappan, Director, The Nilgiri Dairy Farm Ltd, Mr. K. B. Pillai, Chairman, MPEDA, Mr. D. Rajagopalan, Chairman, APEDA, Mr. V. Jayashankar, Chairman, Spices Board, Mr. P. V. Narayanan, Director, IIP, Mr. Kite De Boer, McKinsey and Co. Inc, Ms. Anuradha Desai, Chairperson, Venkateshwara Hatcheries, Dr. R. S. Paroda, Director General, ICAR, Mr. Pradipta K. Mohapatra, President and Chief Executive, RPG Enterprises, Mr. Jagdeep Kapoor, MD, Samsika Marketing, Dr. A.S. Aiyar, Member Technical, CPF, Mr. Nitesh Jain, MD, DCW Home Products Ltd, Dr. S. S. Arya, Director, DFRL and Mr. John Hamilton, John Hamilton and Co.

Venue of all the events:
Taj West End,
Bangalore.

For details contact:
Centre for Processed Foods
P.B. No. 8058,
Sadashivanagar P.O.
Bangalore 560 080.
Fax/Phone : 080-3343676
E-Mail : cpfbang@bgl.vsnl.net.in.

EUROPAIN 99

EUROPAIN 99, the international meeting place for the bakery and patisserie professions, will take place at the Paris-Nord Exhibition centre from 13 to 17 February 1999.

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AFST (I) ANNOUNCEMENT

ASSOCIATION OF FOOD SCIENTISTS AND TECHNOLOGISTS (INDIA)

Central Food Technological Research Institute Campus, Mysore - 570 013, INDIA.

Invites nominations for Conferment of Fellows of AFST (I) for the Year 1998.

The Association has pleasure in inviting nominations from persons to be conferred as "Fellow of Association of Food Scientists and Technologists (India)" (FAFST) to honour those who have contributed significantly to the progress of Food Science and Technology.

General

1. The awardee will be called as Fellow of Association of Food Scientists and Technologists (India) and in an abbreviated form as FAFST.
2. The total number of Fellows of the Association will not exceed 5% of the total membership, including regular and life members of the Association, in any given year or 100, whichever is lower.
3. The title of Fellow has so far been awarded to 40 AFST (I) members and 6 non-members who have contributed to the progress of Food Science and Technology.

Eligibility

1. The aim is to honour persons of outstanding merit who have contributed significantly in the field of Food Science and Technology including R & D, product/Project Development, Industry, Transfer of Technology and Marketing. The merit of contribution should be the main criterion.
2. Among the Fellows to be nominated every year, 70% will be from AFST (I) and remaining 30% may be from non-members who have contributed significantly for the development of Food Science and Technology.

Nominations

1. The nomination for Fellow should be proposed by 5 AFST (I) members of good standing for a minimum of 5 years or by 2 Fellows of the Association. This is applicable to AFST (I) members as well as non-members.
2. Any regular or life members of AFST (I), who has been continuously a member of the Association can sponsor the nomination for only one Fellow in a particular year.
3. The nomination shall be accompanied by acceptance of the person proposed.
4. The nomination shall be in the format given on the following page. A brief bio-data of the nominee, highlighting the Scientific or Technological achievements in the area of Food Science and Technology, supported by a list of publications not exceeding 10 important research papers or other supporting documents not **exceeding 20 pages,** must accompany the nominations.
5. Central Executive Committee Members of AFST (I) are not eligible to be nominated as Fellows.
6. The nomination duly proposed and agreed by the nominee shall be sent to the Hon. Executive Secretary, AFST (I) by **31st March 1999.**

Selection of Fellows

The nominations received will be placed before an Expert Committee, appointed by the CEC for suitable recommendations to CEC each year, CEC by majority decision will finalise the names of Fellows for each year. **The decision of CEC in this matter will be final.**

Privilege of a Fellow

The Fellow shall be entitled to the following rights:

1. The awardee will be entitled to add FAFST after his/her name as short title.
2. To be present with voting rights at all general body meetings.
3. To propose and recommend the candidates for Fellow of the Association.
4. To receive *gratis* copies of one of the publications of AFST (I)
5. To fill any office of AFST (I) duly elected.
6. To be nominated to any committee of AFST (I).
7. To offer papers and communications to be presented before the meeting of the Association.
8. The title will remain for life time of the member.

Cessation of Fellow

1. Any Fellow may withdraw his/her title of the Association by signifying his/her wish to do so by a letter addressed to the Hon. Executive Secretary, AFST (I), which will be placed before the CEC for acceptance.
2. If the Association comes to know of any activity prejudicial to the Interest and well being of the Association, the CEC will have the right to withdraw the title.

Conferring as Fellows

The Fellow will be conferred with a Citation at the time of AGBM or at any other suitable function of the Association.

The Association may invite some Fellows, nominated each year, to deliver special lectures in the area of their specialization either at the AGBM or any other function arranged by the AFST (I).

Please forward your nominations duly filled as per the format given on the following page and mail it by Registered Post to the Hon. Executive Secretary, AFST (I), CFTRI campus, Mysore 570 013, before **31st March 1999.**

The envelope containing the nomination along with the bio-data and contributions **(6 copies)** should be superscribed 'Nomination for Fellow AFST (I)'.

A.D.SEMWAL
Hon.Executive Secretary

ASSOCIATION OF FOOD SCIENTISTS AND TECHNOLOGISTS (INDIA)

CFTRI Campus, Mysore - 570 013

Nomination Form For Fellows

We, the following members of AFST (I) wish to propose

Full name and academic distinction

FULL NAME

DATE OF BIRTH

AREAS OF SPECIALIZATION

ACADEMIC QUALIFICATIONS

---

for election as the Fellow of AFST (I). We append below the statement of his/her claims for election as Fellow and certify that in our opinion he/she is fully qualified for that distinction. We also certify that he/she has been informed of the obligations attached to the fellowship of the AFST (I) and is agreeable to abide by them, if elected.

Statement of the proposer (not to exceed 100 words) setting out the discovery, invention or other contribution to newer or process/products or the industrial development of the knowledge made by the nominee.

.....

Seconder's name & signature

Date:

Station:

Proposer's name & signature

Date:

Station:

(Signatures of supporters from their personal/general knowledge)

(1)

(2)

(3)

I agree for the above nomination

(Name & Signature)

.....

Note: (1) Six copies of the candidate's bio-data and list of important scientific publications not exceeding 10 pages and one set of reprints or supporting documents not exceeding 20 pages shall be attached to this form.

(2) Additional information that would be of assistance for considering the nomination may be supplied on a separate sheet.

(3) Last date for receipt of nomination at the AFST (I) office is **31st March 1999**.

ASSOCIATION OF FOOD SCIENTISTS AND TECHNOLOGISTS (INDIA)

CFTRI Campus, Mysore - 570 013

Nominations for AFST (I) Awards for 1998

Nominations for the following awards of the AFST (I) for the year 1998 are invited. All nominations should be sent by Registered post, so as to reach Honorary Executive Secretary, Association of Food Scientists and Technologists (India), CFTRI campus, Mysore - 570 013, **before 31st March 1999.**

PROF. V. SUBRAHMANYAN INDUSTRIAL ACHIEVEMENT AWARD

The guidelines for the award are:

(i) Only Indian nationals with outstanding achievement in the field of Food Science and Technology will be considered for the award.

(ii) The nominee should have contributed significantly to the enrichment of Food Science and Technology and the development of agro-based food and allied industries in India.

(iii) The nominatiions duly proposed by a member of the Association must be accompanied by the bio-data of the nominee, highlighting the work done by him/her for which he/she is to be considered for the award.

(iv) The awardee will be selected by an expert panel constituted by the Central Executive Committee of the Association.

(v) Central Executive Committee Members of AFST (I) are not eligible to apply for the award during their tenure.

The envelope containing the nominations, along with bio-data and contributions **(six copies)** should be superscribed **"Nominations for Prof. V. Subrahmanyan Industrial Achievement Award - 1998".**

LALJEE GODHOO SMARAK NIDHI AWARD

(i) The R & D group/person eligible for the award should have contributed significantly in the area of Food Science and Technology in recent years, with a good standing in his/her field of specialization.

(ii) the nominee(s) should be duly sponsored by the Head of the respective Scientific Institution and the application for this award should highlight complete details of the contributions made by the nominees and their significance.

(iii) The nomination duly proposed by a Member of the Association must be accompanied by the bio-data of the nominee.

(iv) Central Executive Committee members of AFST(I) are not eligible to apply for the award during their tenure.

The envelope containing the nominations along with bio-data and contributions **(six copies)** should be superscribed **"Nominations for Laljee Godhoo Smarak Nidhi Award 1998".**

BEST STUDENT AWARD

The award is to be given to a student having a distinguished academic record and undergoing the final year course in Food Science and Technology in any recognised University in India. The aim of the award is to recognize the best talent in the field and to encourage excellence amongst the student community.

The guidelines for the award are:

(i) The applicant must be an Indian National.

(ii) He/she must be a student of one of the following courses:

(a) M.Sc. (Food Science/Food Technology).

(b) B. Tech., B.Sc. (Tech). B.Sc. (Chem. Tech) with Food Technology specialization.

(iii) He/she should not have completed 25 years of age as on 31st December 1998.

Head of the Department of Food and Science and Technology in various Universities may sponsor the name of one student from each institution, supported by the candidate's bio-data, details starting from high school onwards, including date of birth and post-graduate performance to date **(six copies).**

The envelope containing the nominations should be superscribed **"Nominations for Best Student Award 1998".**

YOUNG SCIENTIST AWARD

The award is aimed at stimulating distinguished scientific and technological research in the field of Food Science and Technology amongst young scientists in their early life.

The guidelines for the award are:

(i) The candidate should be an Indian National below the age of 35 years as on 31st December, 1998. Working in the area of Food Science and Technology.

(ii) The candidate should furnish evidence of either

(a) Original scientific research of high quality, primarily by way of published research papers and (especially if the papers are under joint authorship) the candidate's own contribution to the work.

OR

(b) Technological contributions of a high order, as reflected by accomplishments in process design etc., substantiated with documentary evidence.

The application along with details of contributions and bio-data **(six copies)** may be sent by registered post w in an envelope superscribed **"Nominations for Young Scientist Award 1998".**

BEST PAPER AWARD AND BEST FEATURE ARTICLE AWARD

These awards are given by the AFST (I) Educational and Publication Trust to the author (s), who have contributed the best paper to the *Journal of Food Science and Technology* and best feature article to *Indian Food Industry* published in 1998. A panel of experts, constituted by the Central Executive Committee will scrutinize the issues and select the best paper/feature article for the award.

A.D.SEMWAL
HON. EXECUTIVE SECRETARY

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